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THE OPINION IN THE BERLINER CASE.

Elsewhere in this number will be found the full text of Mr. Justice Brewer's opinion in the Berliner case. To those engaged in telephony it will be of the deepest interest. Apart from its importance in this connection, the fact that it establishes precedents of vital bearing on several industries makes it a very noteworthy document.

To the lay reader, not versed in law, it possesses two features which are immediately prominent. The narrowness of the grounds upon which the decision was rendered, the closeness with which the court adhered to the subject matter of the case as it was presented, and the little effect the decision can have upon the validity of the patent are apparent.

The other feature which cannot fail to strike the average reader is the attitude of defence taken in the opinion. It seems that the court must have felt the almost universal consensus of opinion that the long delay and the extension of an expiring patent by the grant of this new one savored of collusion. Otherwise there could be no explanation of the elaborate defense of the decision of the court contained in this opinion.

ELECTRIC TRACTION IN NEW YORK CITY.

For several weeks the Eighth Avenue Railroad, which is operated under lease by the Metropolitan Traction Company, has been withheld from changing its motive power to electricity by the action of several citizens, who brought suits to obtain an injunction restraining the commissioner of public works from granting a permit for beginning the work to the railway company or its lessee.

The original grant of the franchise in 1851 contained an option permitting the city to purchase the lines at any time at a 10 per cent. advance above the cost price. An offer was made to the city of a sum of $1,000,000 in excess of what they would be required to pay for the roads, should they exercise their option by a corporation which was anxious to acquire them. It was alleged that the permission to construct an underground electric system on these roads would render this bill unavailable and result in a great waste of municipal assets.

Justice Beach, in the Supreme Court, has just denied these injunctions. In his opinion, the judge holds that the consent of the city is not necessary for a change of motive power, although the original grant provided that no other motive power than horses could be used below Fifty-first Street. He also held that the city by its failure for forty-five years to assert any right has shown that their understanding of the contract between them and the railroad company did not include any agreement for the sale of the road on the terms mentioned, and that whereas the city may have had, years ago, some claim in equity under the contract, that now such claim had been thrice barred by the statute of limitations.

The immediate effect of this decision will be an appeal to the appellate court, from which an opinion is expected about the

middle of June. The action in Judge Beach's court, however, is a long step toward the much-desired equipment of the avenue horse car lines.

It is probable that when these lines are equipped with a satisfactory conduit system, and the Manhattan Elevated Railway is properly supplied with electric motors, that the transit situation in this city will be greatly relieved. It does not now seem likely that the underground railway recommended by the Board of Rapid Transit Commissioners will be constructed in the near future, although it is certain that great pressure will be brought to bear by citizens and the press to hasten its completion. Meanwhile, the only hope for rapid transit is in the betterment of the surface systems and the enormous increase in the availability of the elevated roads by the application of electric motors to them.

It may be stated in this connection that recent newspaper reports concerning the decision of the directorate of the Manhattan Elevated railways to equip their lines with electricity are premature. There is little doubt that it is their intention to so equip their lines, but no definite arrangements have as yet been made. This is equally true with regard to the New York & Putnam Railway, which runs northward from the terminus of the West Side elevated roads through Yonkers to Brewster, N. Y.

THE INVENTOR AND THE INVENTORS' JOURNAL.

The sufferings of inventors, those of the obscure type who delude themselves into the belief that a fortune is to be made from the development of some idea they have evolved, furnish a sad spectacle. There are many self-deceived and ignorant men who waste their time and their money, and frequently end in a sort of fanaticism over inventions which are absurd, or at least worthless. The lives of most of these, condemned to work endlessly in the pursuit of a shadow, are sufficiently miserable to entitle them to the compassionate regard of the successful. Their release from their bondage can only be accomplished by their instruction and their enlightenment.

There are no class so unfortunate that some individuals cannot be found to prey upon them, and use their very misfortunes as a means of profit. Even the poor inventors, the struggling mechanics and artisans who think they can revolutionize some important art, the farmhand with a cog-wheel machine for perpetual motion, are the support of knavish patent attorneys, who encourage the delusions of their wretched clients that they may wring out a few more dollars for fees. Not content with such victims as may drift into their nets, these wily individuals lure them by printing and circulating a variety of periodicals, beginning nowadays to be notorious as "Inventors' Journals."

In these the wonderful rewards of successful inventors are described in glowing language. The value of "ideas," no matter how crude or unformed, is preached with fervor. The glittering bait of success is held before the gullible inventor, and he is promptly ensnared. Then the adroit attorney begins to bleed the victim. The whole system, from the plausible journal to the final generally worthless patent, is little better than a heartless swindle.

In another column is an article by Mr. Albert Scheible, in which he suggests that the antidote for the "Inventors' Journal" is the technical press, devoted to the particular line of development in which the inventor is laboring. The suggestion is certainly a good one. Any means whereby the man seized with the inventive fever may be instructed, taught to avoid chimerical schemes, shown what others have done before him, and generally kept out of trouble, is good and deserving of encouragement.

THREE-PHASE RAILWAY MOTORS.

In another column is a very interesting letter from Mr. A. E. Levin, concerning the construction of the locomotives for the Jungfrau Railway. It appears that this railway is to be operated by three-phase currents in a manner similar to that at Lugano and the Gorner-Grat Railway in Switzerland. It is also stated that this method is to be used on two other important railways in Switzerland, one of which is twenty-two miles long.

This development of three-phase railway systems in Europe is very interesting, and is worthy of very careful attention on the part of American railway engineers. The enormous difficulties connected with any system requiring a doubling of the trolley wire, however, would seem to operate against its use, certainly to any very great extent, in this country. Those who remember the early electric railways on the double trolley system in this country will appreciate the gigantic difficulties of operating anything except a straight line, without switches or turn-outs, upon any system that requires other than a single suspended conductor. These difficulties increase geometrically with the increase of potential, and would thus seem to limit in another way the availability of three-phase systems for railway purposes.

The very high efficiency of rotary transformers seems to indicate what is probably the best way of using polyphase currents on long railway lines. By the installation of these machines at convenient points, three-phase currents at high potential may be generated and sent out from the central station to conveniently located transformers which will serve to reduce them to direct currents of 500 volts, or some other easily controlled potential. These machines require little care and attention, and their efficiency even at low loads is surprising. There seems to be no reason why long railways should not be successfully operated in this way.

The direct current car motor has reached such a point of perfection in its design and is now so thoroughly understood that it does not seem easy to improve upon it. It is likely that a combination of rotary transformers and the standard type of direct-current railway motors would make the most effective solution for many of the long-distance railway projects now being discussed.

COMBINED TROLLEY AND ACCUMULATOR SYSTEMS.

The recent official report on the operation of the combined overhead trolley and accumulator systems installed at Hanover, Germany, is very interesting, and shows some remarkable results attained by the operation of railways on this method. In Hanover the overhead system is not permitted in the more populous parts of the city, so that the accumulator method was necessary for the working of portions of the railways. Each car is equipped with a battery of accumulators, which receive their charge while it is upon the trolley-operated section, and serve to propel it after the car enters the district in which the overhead lines are forbidden.

The cost of such a system is not so great as might be at first imagined, when the saving of the overhead line construction in the accumulator-operator district is considered. Probably the cost was less than if a conduit system had been installed in the business district of the city. The operation costs, also, did not exceed that of the simple overhead system by more than one-fourth of a cent per car-kilometre, or, roughly, four-tenths of a cent per car-mile.

These results are very encouraging, and serve to show that the accumulator is rapidly reaching that point of operative stability which entitles it to very serious consideration for traction purposes. The method in use in Hanover is one that may find much practical use, and deserves careful study.

The Inventor and the Technical Journal.

BY ALBERT SCHEIBLE.

Progress in the electrical line depends largely on men of ideas—and what thinking man is there that does not have frequent ideas such as might blossom into useful and money-earning devices? If the idea is developed into a reality we call it an invention, but very few ideas reach this stage of development. Most of them are dropped while still mere buds, others are partly opened out before they are thrown aside, and only very few are given the time to bloom into a reality. The fate of the idea depends largely on the inventor himself, and he in turn is guided both by his business environments and by the reading matter within his reach, though few inventors seem to realize the effect of these influences on their work. To be sure the average inventor is eager, very eager, for progress, and therefore willing to take any hints which might make his work more enduring and effective, but he is often subjected to just the worst sort of influences without being aware of it. He may not realize what some of us call "the power of the press," yet he cannot escape from it. His only safeguard lies in calmly surveying the reading matter within his reach; then if he can see what effect journals of various classes may have on others of his stamp, he can bar out anything that might be misleading and pick what is sure to be helpful.

With this in view, let us look at some of the periodicals which we find close at hand, and note their inherent tendencies, for it is these tendencies which mould the effect of the paper on its readers. First in accessibility is the ordinary newspaper, with its sprinkling of semi-technical articles, which range all the way from the accurate and reliable to the purely and recklessly imaginative. Perhaps all of these articles have their proper sphere, but a single reliable article will often inspire credibility for countless others based on the imagination of a technically ignorant and not overscrupulous reporter. Then how is the reader to tell what is truth and what is fiction in these newspaper articles? Even the reprinting of articles which have appeared in technical journals is not always safe, as the man with the shears may clip only a portion of the original article, and this may be misleading when taken out of its original connection. So we may well ask ourselves if it is wise for us as inventors to pay much attention to what appears in our daily or weekly newspapers.

But the man of ideas rarely confines himself to the newspapers for his inspiration. He wants some literary reinforcement every week or every month from what seems to him more reliable sources. Then he is confronted by two classes of periodicals, and it is to these that I want to call special attention. The first class (and the one which is most actively urged upon the average inventor) is that of the "Inventors' Journals." These parade under various names, and with few exceptions help to advertise the patent agency run by the publisher of the paper. Nominally such a journal will claim to work for the reader's interests, but when you analyze the case carefully you will usually find that the efforts are directed at getting each reader to pay repeated fees to a certain patent solicitor. The more numerous the patents, the more fees will the inventor pay; hence we must not be surprised to find such a paper advising the general and indiscriminate patenting of ideas, regardless of whether or not there is any possible chance of their being of value. Some of them even offer premiums to entice ideas which otherwise would get their well-deserved shelving. Should any doubt exist in the mind of the inventor as to the patent-worthiness of his device, they divert his attention from this uneasiness by offering to refund his fee in case they get no patent for him. In other words, they guarantee to help him spend his money in getting some sort of a patent, regardless of the probable commercial worthlessness of the document they obtain for him. What matter to them if the device had been broadly covered by a previous patent, so that the inventor could not market it without inviting trouble? They might still procure a detail patent on a specific modification of the old idea, and "a patent" is all they agree to get. Whenever this is the case the money required has simply been thrown away, and there may be none left to spend on a broad patent for a really novel and promising device. Every issue of the Patent Office Gazette contains hundreds of just such patents, which mean a complete loss of both time and money to the inventor, merely because he followed the advice of such a patent-enticing sheet.

But much as the existence of such journals is to be deplored, it must be remembered that they are supported, and to a large extent encouraged, by the men of ideas, who ought to have better notions as to their proper course. These papers merely echo and impress some common but false notions about patents, so we must correct these ideas before we can suppress such journals. Chief among these notions is this: that the patenting of an idea gives it value. Now, any one who has read the wording of a patent knows that it makes no pretense in this direction; it merely gives a temporary governmental protection to the inventor so that he may exploit his device and reap returns from it himself instead of having others copy it and thus steal the benefit of his time and thought. If the device patented was a worthy one and one that would sell at good profit, the inventor can make money; but if it had no prospects of commercial success in it (so that no one would trouble himself to copy it) what is the use of spending money for a seventeen years monopoly of it? The most remunerative inventions are usually those which would bring good returns even if not patented; but they might never be fully developed, or might be kept secret and lost to the public. Hence the Government says to the inventor: "Come, tell me all about your device, so that any one can learn how to make it. If you have something new, my people want to have the benefit of it, and you ought to be the sole maker for many years, so that you may reap the returns for your labor. I will give you a seventeen-year monopoly on anything new and useful that you will fully disclose to my people." Does the average inventor realize this as the gist of our Patent Office methods? Hardly. To him a patent is something which gives an imaginary value to his ideas, for why should he pay from seventy-five to a hundred dollars for a Government paper if that did not brand his invention as belonging to the same category of bright ideas from which others have made fortunes? Then when a patent is issued to him he feels that he has something of great value in his invention. If he would then wait until time shows the truth or fallacy of this belief, he might save himself a good deal of money and of worry; but he may strike another and apparently promising idea very soon and he thinks that this must be patented, for what value would be apparent in it without a patent? Then his favorite journal is the one which tells about the inventions needed; indeed, he thinks that any printed list of "hundred inventions needed" must cover the ones wanted from him. So away goes his cash on Government and attorneys' fees, for it rarely takes a person of good imaginative power long to evolve quite a number of patentable ideas. Now is this a logical procedure? Does it not stand to reason that the inventions most needed and most likely to be remunerative must also be the most difficult ones to evolve, and that they must usually be worked out by those most familiar with the particular class of work to which each one relates? Will an outsider who spends a few hours or days in thinking about something in your line of work be likely to understand the real needs as you have learned them by years of observation? And is such an outsider apt to know what has already been tried for the same purpose, so as not to practically duplicate what may have proven to be a failure? It seems to me that one who would invent a really patent-worthy device must make himself quite familiar with the exact conditions under which such a device would be used and also with the history of other attempts at filling the same need. The average man of inventive talent does not do this, does not even stop to think about his work from this standpoint. Then the years roll on, Fortune forgets to shower her riches on him and he wonders what it was that he overlooked; or if he sees how rashly misguided he was, he may ask where he could have found better guidance.

Where shall the inventor of to-day look for guidance? The answer is not far to seek, for thousands of men who have gotten good returns for their labors can point to the same source of help and of inspiration—the technical paper. One of the great factors in modern progress (brought about largely by the inventions which have cheapened printing and engraving) is the array of technical papers devoted to particular lines, each of them able to present topics with that thoroughness which comes from specialization. Thus it is natural that men who have made a special study of electrical work should be able to give the most reliable reports of whatever is going on in the electrical world. They may not show the flowery and imaginative style of the all-round reporter, who can write up any kind of a subject at an hour's notice, but they

know how to judge the real novelty and prospects of whatever they write about.

Probably no line of technical papers is better adapted to serve those who are interested in experimental or research work than the electrical weeklies of our own country, and it is hard to overestimate the effect of these papers in making electrical inventions not only patentable, but valuable as well. How do they do it? They tell about the work done by ever so many investigators (both here and abroad), so that the reader can profit by the work of others, instead of spending time and money in repeating the same experiments. They also show what devices are being put on the market to meet certain needs and how well they seem to meet the conditions of practice, thus hinting at the openings for well-paying contrivances. The reading columns are always telling about such new inventions, the patent briefs tell about many more and some papers even classify these patent clews so that it takes but a few minutes to run over each week's patents in any particular branch of the electrical line. This classification is also very helpful in the abstracts or "digests" of articles which have appeared in other journals, so that the reader who is interested in any special phase of electrical work can promptly find a good deal relating to just this phase.

But more than all this, the electrical weekly of to-day gives its reader a good survey of what is going on in the whole electrical field, so that he can bring to his special little line of study a broad understanding of the greater subject and a knowledge of such work in the allied lines as may be helpful and suggestive to him. This same sort of an electrical weekly may at times tend to discourage one from following some pet scheme, but what of that? Too much time and money is already misspent in the electrical as in every other progressive line, and the inventor who is turned from following a purely visionary scheme often finds ready for him some other more humble but really promising one. So if I were asked to prescribe for one who is short of funds and discouraged at not getting returns from patents granted to him for electrical inventions, I should advise him to take weekly doses of some wideawake and carefully edited periodical devoted to the subject. Such a guide and helper would soon show him where and why he erred in his expectations and how differently he must proceed in order to meet the real needs of the day—for why should any invention be worthy of commercial success (and hence a patent) unless it does this?

Niagara Falls Convention of the National Electric Light Association.

We are informed by Secretary Porter that the Trunk Line Association, the New England Passenger Association, the Central Passenger Association and the Southern Passenger Association have made a rate of a fare and one-third on the certificate plan, from all points in their territory to Niagara Falls and return, to delegates to the twentieth annual convention of the National Electric Light Association, which will be held at Niagara Falls on June 8, 9 and 10, next. An arrangement has been made with the West Shore Railroad to run a special train of vestibuled parlor, library and dining cars, leaving New York from the foot of Forty-second Street, North River, at 10:15 A. M., and from the foot of Franklin Street at 10 A. M., on Monday, June 7. The return tickets will be available on either the West Shore or the New York Central & Hudson River Railroad.

It is stated that a large number of ladies will join the party, for whom souvenirs have been provided. The price of tickets to Niagara Falls from New York, including a parlor-car seat, is $10, and arrangements for tickets and accommodations on the train can be made through Mr. C. O. Baker, Jr., 136 Liberty Street, New York, master of transportation.

American Machinery in England.

It appears that the whole or a greater part of the rolling stock for the new underground electric railway in London, known as the Waterloo & City Railway, has been ordered from America, much to the disgust of the English manufacturers. There are a few other things which we can also sell them to their own advantage.

The Jungfrau Railway.

To the Editor of The Electrical World:

Sir:—In your issue of February 20 I notice a paragraph with reference to the Jungfrau Railway, in which you note that it will probably be carried out with three-phase currents. It may be of interest to your readers to know that this has now been definitely decided.

The great success of the three-phase tramway in Lugano—the first example of the use of three-phase current for traction work without the intervention of rotary transformers—was the principal consideration which led to this decision. The above tramway has now been working about a year, and has completely disproved the gloomy forebodings of those who condemned the system on the ground of want of starting torque and difficulty of regulation. In both these respects it has shown itself to all intents and purposes as good as continuous current, while the obvious advantages in simplicity of the motors, automatic regulation of speed when the rotating part is short-circuited, and the possibility of using ordinary transformers for reducing the high voltage of the long-distance transmission, need not be explained at length.

Soon after the Lugano tramway was started, the promoters of the Gorner-Grat Railway decided to adopt Messrs. Brown, Boveri & Co.'s project for working their line by the three-phase system. This railway is in some respects analogous to that up the Jungfrau. It is a rack railway running from Zermatt (5300 feet) to the summit of the Gorner-Grat, a famous point of view lying at an elevation of 10,290 feet. The gradients are very severe, being as much as 20 per cent. over the greater part of the line. The power will be generated by means of turbines driven by the Findelenbach and coupled direct to three generators of 250 horse-power each. There will be three transformer stations, transforming from 5000 to 500 volts. The whole length of the line is six miles. The motor cars are equipped with two motors of 90 horse-power each, and will each take one trailer, the two vehicles together carrying 110 passengers. It is expected that this line will be run for trial trips this summer.

The locomotives for the Jungfrau Railway will have very similar equipments to the above, and the order for them has also been placed with Messrs. Brown, Boveri & Co.

But it is, of course, in long-distance traction that the three-phase system gives the greatest advantages. It is now to be applied to two important railways in Switzerland—the Stansstaad-Edelberg line, and that from Burgdorf to Thun. The former is about eighteen miles long and is mostly on small gradients worked by adhesion. About one and one-half miles have a gradient of 25 per cent., and here special locomotives will be used, with a rack between the rails. The Burgdorf-Thun Railway will be about twenty-two miles long, and the contract for the entire electrical equipment has just been granted to Messrs. Brown, Boveri & Co. The whole is to be running by April, 1899.

It will be seen that the use of three-phase current for traction has already made great strides on this side of the Atlantic, and the further developments cannot fail to have important influence on the future of long-distance roads. A. E. Levin.

Zürich, Switzerland.

Train Lighting.

According to a Swiss engineering journal there are now in Switzerland 525 passenger cars which are lit electrically, and the number is continually increasing. On some lines all the trains are to be equipped with this system and on some of the others it is introduced on all the new cars.

A Truly International Installation.

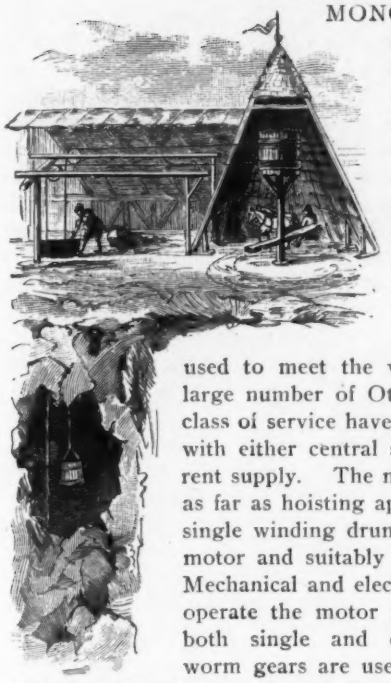
In a recent accumulator station in Paris the boilers are American, the engine English, the dynamo Swiss and the accumulator and measuring instruments German. We presume the capital in the enterprise was French.

A Victory for the Trolley System.

After considering the subject for a long time, Glasgow, Scotland, has at last decided to introduce the overhead trolley system.

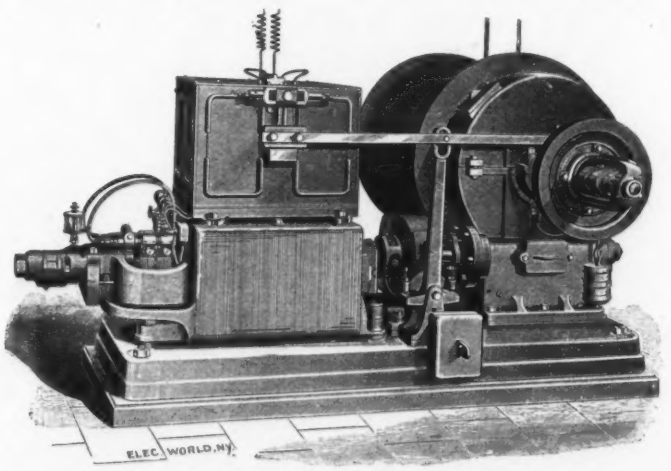
Electric Elevators.—VII.

OTIS ELECTRIC ELEVATORS.



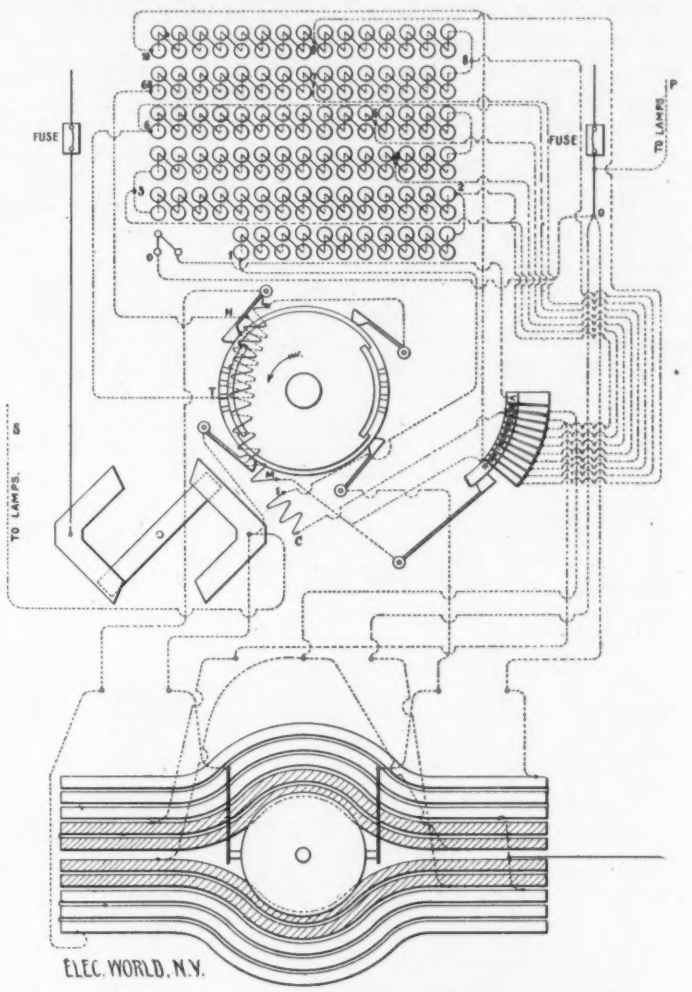
AMONG modern electric elevator machinery the apparatus manufactured by Otis Brothers & Company occupies a prominent position. This concern has been a pioneer in the development of nearly all types of elevator machinery. The electric apparatus built by them is all of the drum-winding type, but a great variety of controlling and operating methods are used to meet the various conditions. A very large number of Otis elevators for almost every class of service have been installed in conjunction with either central station or isolated plant current supply. The machines are generally similar as far as hoisting apparatus goes, consisting of a single winding drum worm geared to an electric motor and suitably mounted on a heavy base. Mechanical and electrical control from the car to operate the motor switches and regulators, and both single and duplex interlocking tandem worm gears are used. The method of gearing, control and regulation adopted depends on the service for which the elevator is intended. Eickemeyer ironclad bipolar motors are used on all styles and sizes of Otis electric elevators. These motors are built entirely by this company, and retain the same general features as when originally designed and developed by the late Rudolph Eickemeyer. The field consists of a casting of two halves enclosing the drum armature, which is almost encircled by the field windings. A heavy construction and intense field give a moderate speed in nearly all sizes of these motors, ranging from 5 to 50 horse-power.

The motor is usually fastened at one end of the L-shaped base casting, and is entirely self-contained. A coupling, also serving as a brake pulley, connects the motor shaft to the screw shaft of the gearing, which, whether single or double, runs in an oil-filled casing, which entirely encloses it. The top half can readily be removed and various covered openings are provided for easy inspection. The lower half of the casing has the screw shaft bearings, one at each end. The ordinary form of screw gearing is used, consisting of an accurately cut steel screw and phosphor-bronze worm wheel. The latter has a central steel hub and web, to which the outer toothed ring is bolted. When a single gear is used the outer end bearing serves as a thrust bearing. With this type of gearing the worm wheel is mounted on the drum shaft, which projects through the casing, being supported by a bearing on each side of the casing and at the other side of the drum. On the projecting end of the shaft the limit and slack cable stops are mounted, and when ordinary hand-rope control is used the operating sheave is also fitted thereon.

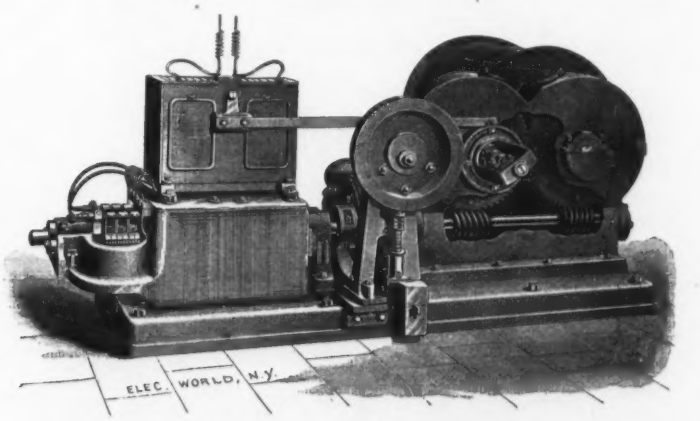


SINGLE WORM GEAR ELECTRIC ELEVATOR.

For high-class service duplex interlocking worm gearing is used. The screw shaft has two opposite tandem screw threads of rather coarse pitch which engage with their respective worm wheels. One is mounted on the drum shaft and worked by the furthest screw; the other is fitted to an extra short shaft supported in bearings on the sides of the gear case and projecting through at one side. The worm wheels interlock directly without any additional gears. To give satisfactory results the teeth are cut on the worm wheel as perfect spur teeth, but slightly at an angle to the axis of the shaft. The teeth are then concaved slightly in the centre on each side, to properly fit the worm. The various stops and operating devices are fitted to the projecting end of the separate short shaft, instead of to the drum shaft.



MOTOR AND CONTROLLER CONNECTIONS. DRUM ELECTRIC ELEVATOR.

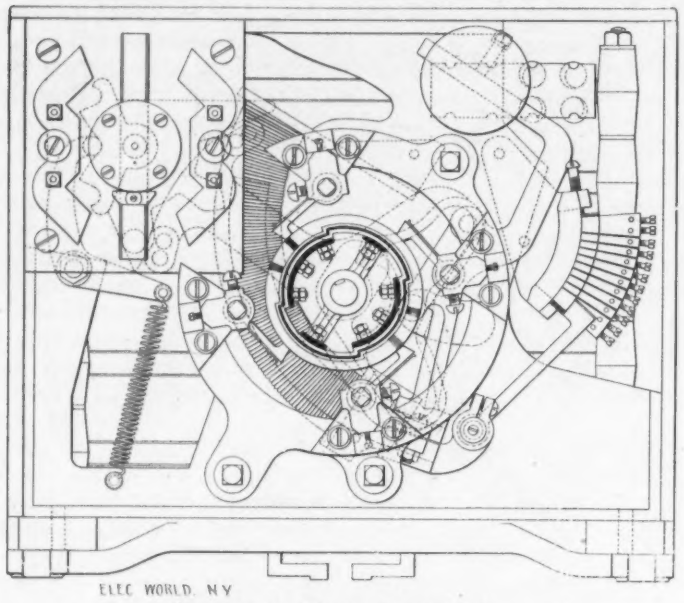


DUPLEX TANDEM WORM GEAR ELECTRIC ELEVATOR.

Special attention has been given to the braking appliances used on these machines. The band type of brake is used, and only applied in stopping. In its simplest form it consists of a compound steel and leather band, the latter in contact with the pulley. This brake band completely encircles the pulley, being flexibly anchored on one side, while on the other the two ends are fastened

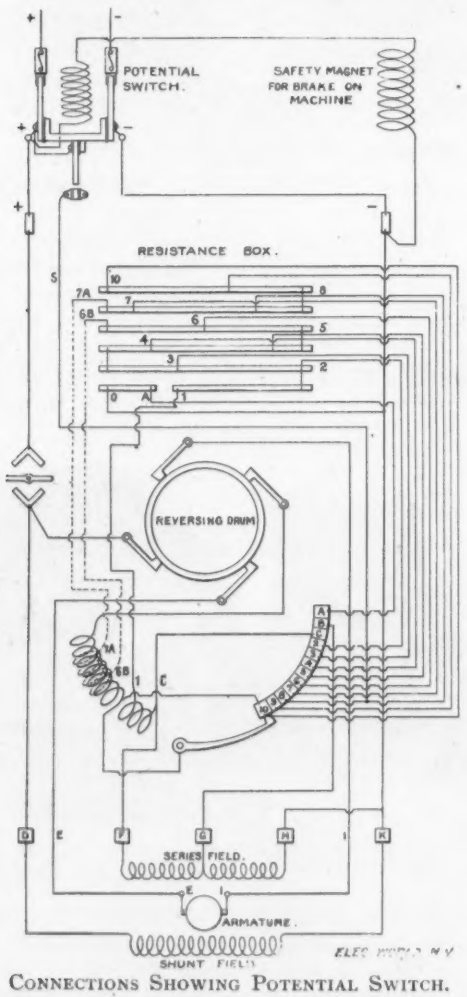
to the opposite short ends of the operating lever, which is weighted at its long end. Raising this lever by means of the connecting rods raises the brake band. A pressure downward on the rod, acting with the weight, has the opposite effect.

In stopping an elevator car at the upper or lower limits a peculiar condition presents itself, which has led to the development of a



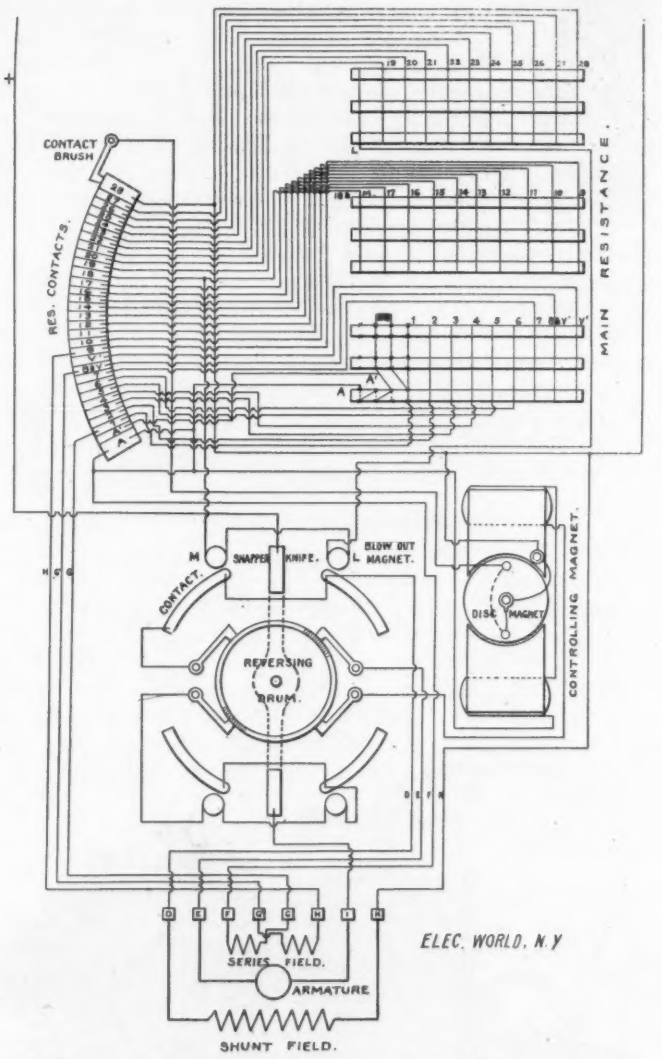
Details of Motor Controller.

double-pressure braking mechanism, whose operation is unique and ingenious. The rod leading to the brake-operating lever is connected to the outer strap of a double eccentric. The outer eccentric is attached to the operating sheave and when operated ap-



Connections Showing Potential Switch.

plies a pressure which is sufficient for ordinary stopping between limits. In conjunction with the operation of this eccentric the motor switch and controller is operated by means of a suitable connecting rod. The inner eccentric is suitably connected to the safety stops, and, having a larger throw than the outer eccentric, applies a heavier pressure on the braking mechanism when operated. In this fashion the ordinary stop-braking action is not as strong as that applied by the limits. In high-speed work, for which class of service this method is particularly intended, the momentum of the moving car must be checked instantly without any possible slipping, should the limit of travel be reached and the automatic stops set in action. This additional braking pressure, which is only put in action under such conditions, serves as an increased check. In conjunction with this double mechanical pressure arrangement, an electromagnetic release is provided, which, when the current is ruptured, automatically releases a weight and applies a brake band of somewhat different construction. This band is in two parts, one end of each being connected to the mechanical operating lever. One of the other ends is immovably fastened to the pin at the top of the standard, which forms the fulcrum of a heavily weighted lever to one end of which the upper strap of the brake is fastened. A magnet on the standard nor-

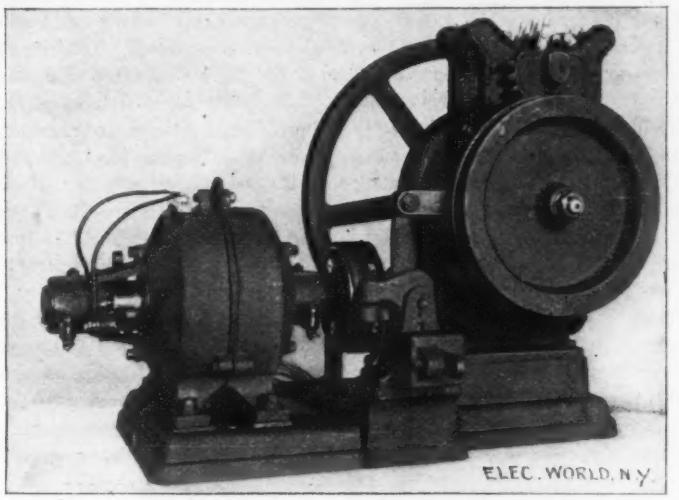


Connections for High-Class Drum Electric Elevator.

mally holds the weight from falling by means of a stop controlled by the armature, and as long as the current is on this end of the upper brake band is fixed. When, however, the magnet is de-energized by a rupture of the current supply, the weight is released and applies the upper brake band. This automatic electromagnet brake release is also sometimes used with the single pressure brake. Electrically applied brakes are used with some electrically controlled elevator machines which will be described later.

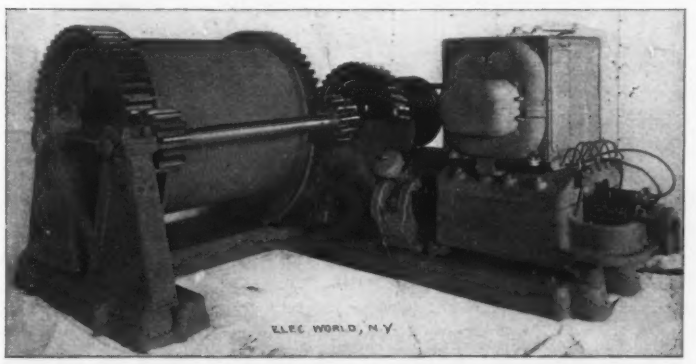
A mechanical control from the car by means of rope-operating devices is most generally used for standard passenger and freight service. When an ordinary hand rope is used, the rope is fastened to a shipper-operating sheave on the drum or double-gear shaft. This hand-rope operated shipper sheave is geared down to give a short movement to the motor regulator bar and brake arm connected therewith. On the other hand, the safety devices are ar-

ranged to operate the shipper sheave. The slack cable safety consists of a keyed clutch collar on the main shaft, which co-acts with a corresponding collar connected to the rope sheave. The limit stop is of the sliding guide nut form, moving on a threaded portion of the main shaft. When this strikes a stop at either end of its movement, it causes the operating sheave to rotate with the shaft. When a lever or wheel-operating device is used



GRIP SHEAVE ELECTRIC DUMB WAITER.

in the car the movement of the rope is less, it being then fastened to a sheave on a separate standard next to the brake wheel, which is connected with the brake mechanism, the motor regulator and also with the slow side of the intermediate gearing, operated by the automatics as previously described. With either method of rope operation this arrangement applies the brake, and operates the regulator gradually, should the safeties act, instead of suddenly as would be the case if the safeties operated directly on the brake and regulator rods. An important feature in connection with the automatic stops is the loose-motion stop. For the reasons requiring heavier braking power in the limit-stop operation, it is also equally essential to provide some means to prevent the carrying over of the operating device to the opposite side beyond the stop point and cause an opposite movement of the car instead of stopping. To prevent this action a blind section is arranged in one of the gears between the operating sheave and regulator

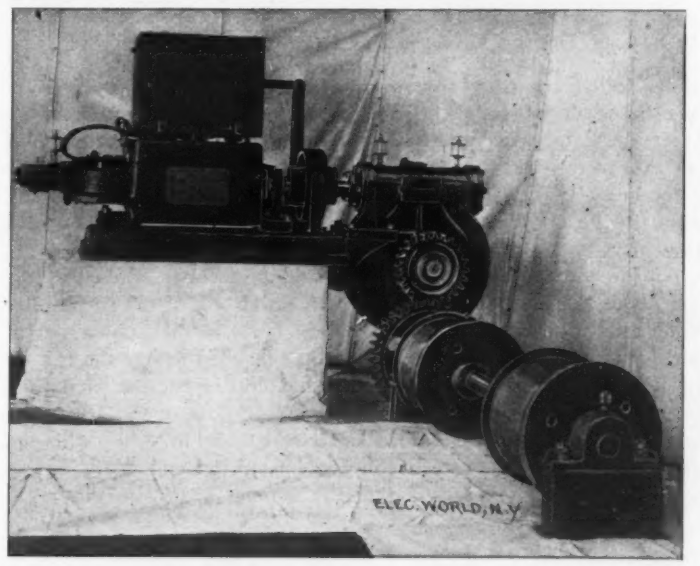


HEAVY FREIGHT ELECTRIC ELEVATOR.

and brake operating bar, so that the sheave can be moved by the automatics, or manually to some extent, on either side of the central stop position, without any effect.

These electric elevators are usually counterbalanced for a certain percentage of the load in the car. The motors operate in both hoisting and lowering, and with the more efficient duplex gearing can be arranged to return current in descending, as the motor is shunt wound when in full operation. On top of the motor is the regulator box containing the switches and starting rheostat. Various methods of motor control are used with the different types of elevators. To control and operate the driving motor used with the type of machine above described, a compound winding is used, with a fixed shunt field and a starting resistance in the armature circuit controlled by a series solenoid or magnet, which only allows the resistance to be varied in inverse proportion to the starting current taken. The main and reversing switches close the circuit and properly connect the motor. The series field winding is only used in starting and is entirely cut out when the motor has attained its full speed. With this arrangement of controlling apparatus the motor, after being started, operates as a shunt motor at a single fixed speed which cannot be affected in any way by the operator. A cam controls the operation of the resistance contact arm, which is held until the switches have been in contact for a short interval, enabling the motor to start before the resistance is decreased.

The connecting bar from the automatic and manual operating devices and brake mechanism is connected to the main spindle of the regulator to which it imparts a short rotary movement by means of a pinion and rack or lever connection. On this spindle is mounted the reversing contact cylinder with four contact brushes The internal cam and the operating bar for the main snap switch are also fitted to this spindle. The core of the solenoid has a main resistance contact brush attached to its outer end, to which a pivoted lever is attached, the outer end of this being weighted. A roller pin between the central fulcrum and the core co-acts with the cam, so that when the spindle is in its normal position the central raised portion of the cam holds the pin and prevents any movement of the contact brush. A movement of the spindle in either direction, closing the main and reversing switches, also turns the cam so that the pin is no longer held by the raised por-



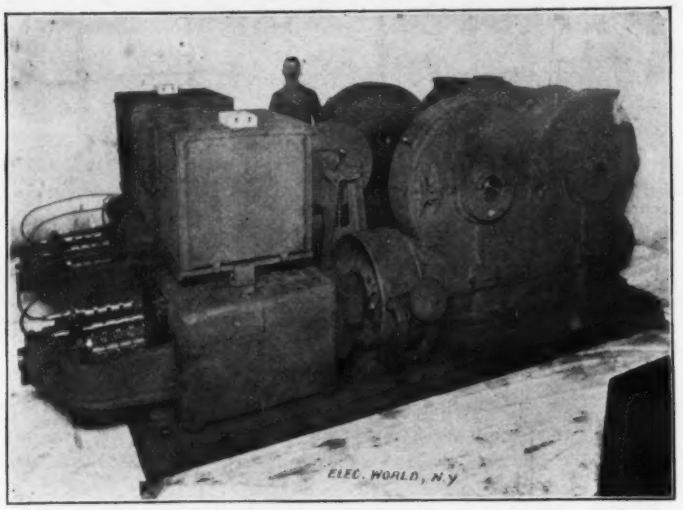
SIDEWALK ELECTRIC ELEVATOR.

tion, the released lever then allowing the contact brush to be moved over the resistance contacts by the weight, which is counteracted by the solenoid worked by the main current. The latter is wound in three sections, two of which are gradually cut out as the contact arm passes over the resistance contacts. The main starting resistance is placed in the rear half of the regulator box, and consists of open-air coils of german silver wire. The series field is divided into two parts, both of which are also cut out when the contact brush has reached the full speed position.

In conjunction with these regulator devices a main automatic release potential switch is used. This switch is located on the wall adjacent to the elevator motor. It has a double-throw blade arrangement, one side of which serves as a main double-pole switch, while the single-blade side, when in contact with the clip, short-circuits the armature through part of the main resistance. In closing the main switch side, the release magnet holds the switch in this position against the tension of a spring, which acts to open this side and connect the other when the magnet is de-energized by a rupture of the current supply. The switch-release magnet is in series with the previously mentioned brake-release magnet, used with the double-pressure brake, and both magnets are directly across the main line.

After closing the main potential switch, which connects the machine to line and energizes the brake and switch release mag-

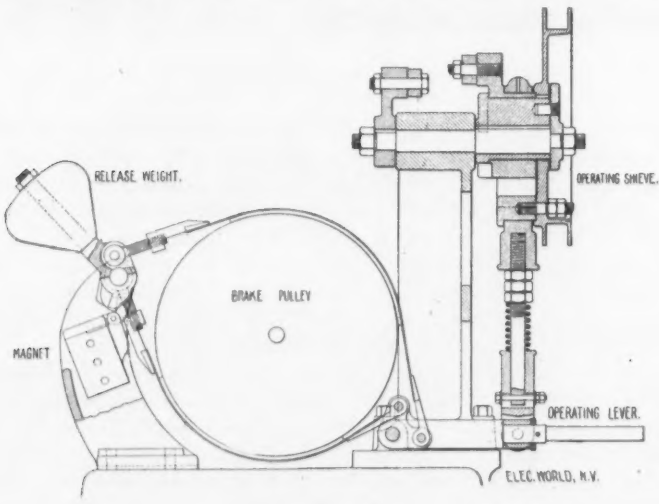
nets, the starting in either direction is as follows: The movement of the shipper operating sheave is transmitted to the regulator spindle, which, at its first movement, turns the reversing cylinder to properly connect the armature to line for the desired rotation, and then throws the main line snap switch. At about the same instant the brake is released, permitting the motor to start. The armature is now in series with the reversing switch, large solenoid coil, all the resistance, and also both small solenoid



Double Motor Drum Electric Elevator.

coils, which are connected into the resistance. When the cam has been turned sufficiently so as to release the contact brush lever, the latter will be moved over the contacts by the weight, but its movement will be entirely controlled by the current in the solenoid. If the current is excessive, above the set limit, at any point of the resistance, which is adjustable, the brush will be held stationary until the current has sufficiently decreased.

As the contact brush moves over the contacts it gradually cuts out about half the resistance, at which point one of the small solenoid coils is also cut out. More resistance is then taken out of the armature circuit, until the brush has reached nearly the full on position, when the other small solenoid coil is cut out, and then both sections of the series field, the motor now operating at full speed as a shunt motor with a small resistance in series with the armature. A safety wire is connected from the end of the resistance contacts to the terminal of the contact brush, so that even

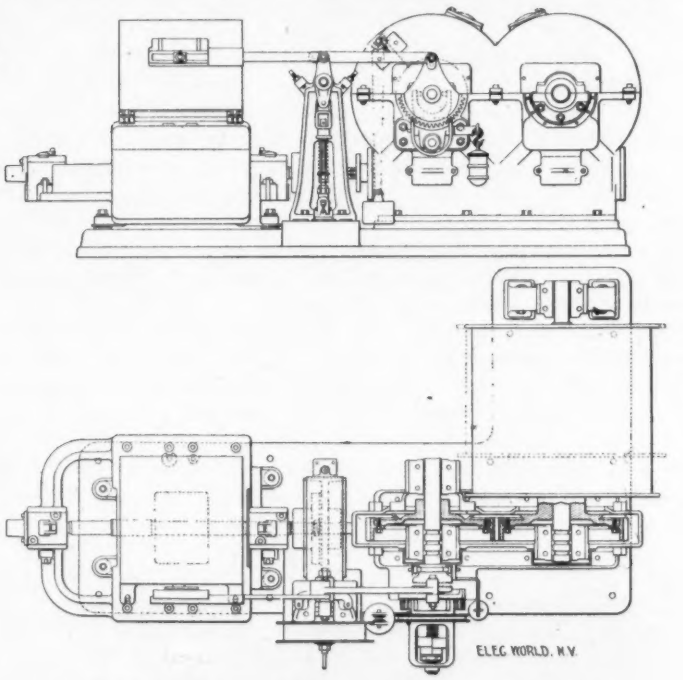


Details of Brake.

though the connection between the brush and resistance should be broken, which would ordinarily de-energize the motor, the entire resistance will be inserted.

In stopping the elevator, the reverse movement of the regulator spindle transmitted through the operating devices at once breaks the main line switch and brings the reversing switch back to the normal position, the brake being simultaneously applied. The main resistance contact brush then falls back to its normal position. This entire arrangement provides a quick, short movement stop for the motor and constitutes a modified automatic motor starter with series checking coil. Owing to the large section of the solenoid which is left in circuit with the armature after the full speed has been attained it is impossible to overload the motor. As the current increases, the core is drawn up by the coil, thereby inserting resistance.

For elevators requiring from 5 to 12 horse-power the above regulator devices are used, but on larger machines, up to 50 horse-power, a somewhat modified arrangement is provided. While the general principle of operation is retained, the main switch and magnetic starting device is changed. The main resistance is also divided into a larger number of sections. The main regulator switch is mounted on the main spindle and has double break and throw snap knife contact blades. Blow-out magnets are placed at each break, one pair of which remains constantly in circuit, the other pair being cut out when about half the resistance has been cut out. Instead of a solenoid for controlling the movement of the contact brush, a commutatorless motor retarding device is used. This consists of a field magnet with an iron drum or disc armature between its poles. A single coil is wound on the armature through two diametrically opposite longitudinal holes close to the peripheral surface. To the spindle of this armature the contact brush is connected through suitable levers, the movement being primarily controlled by the cam on the main regulator spindle.



Plan and Elevation of Duplex Electric Elevator.

Both the armature and field windings are permanently connected in series with the main motor armature.

From the previous description, the operation of these regulating devices by means of the automatic stops will also be understood. It is to be noted that the single contact from the main potential switch is connected to one of the main resistance contacts, leaving some resistance on each side. Should this switch be released either manually or automatically by a rupture of the current, the motor armature is disconnected from the line and short-circuited through the resistance on one side or the other of the point of connection, depending on the position of the contact brush. The brake is also applied at the same instant by the brake-release magnet, thus bringing the motor to a quick stop.

Aside from the standard passenger and freight electric elevator machine, sidewalk, extra-heavy duty, dumb-waiter and other special machines are built by this concern. Regulating devices similar to the above, mechanically controlled, are used. All these machines are also of the worm-gear drum-winding type, which operates the hoisting cables by means of a grip sheave. The motor of this elevator machine is operated without starting resistance. A very large heavy-duty freight machine is illustrated, in which speed reduction is made through spur gears from the drum-wheel shaft to the drum. The sidewalk elevator is similarly arranged.

The Telephone Repeater.

BY LIEUT. F. JARVIS PATTEN.

Is electrical invention dead? Sometimes I ask this question seriously, because it is a fact that the field of applied electricity has not received a single contribution of any pronounced originality in many years. I cannot recall any broadly new invention since Mr. Tesla gave us the rotary field motor in 1888. Of course there has been the regular weekly issue of fifty to seventy-five patents in the electric arts, but it is difficult to find one among them that is not for some trifling detail, or improvement of a minor character. This is partly due to the fact that real new things are actually rare and difficult to find, but I believe it is also due in a large degree to the fact that the older inventors, who accomplished so much ten or fifteen years ago, have not the same incentive to work that they had then. The field is not so open now, and electrical enterprise is controlled by a few large concerns.

Besides this, there seems to be a growing disposition in the minds of the engineers and inventors of these great corporations to assume that all the good things in their line have been done, and little more that is new is to be expected from them or anybody else.

In no field of applied electricity is this more apparent than in telephony, where a great monopoly practically owns everything, and the consequent difficulty of enlisting capital to antagonize so strongly entrenched an organization.

The telephone art has nevertheless more patents to its credit than any other single department of electricity, but very few of them have been issued during the last five or six years; so few indeed when compared with the vast number issued in the eighties that the art seems to have come to a standstill.

Is this because the art is finished? I cannot believe that it is.

Particularly meagre is the number of patents for telephone relays, designed to retransmit speech from one line to another automatically. In the entire art, including as it does some 6,000 patents, I find only forty for repeating instruments; so small a percentage that a description of the entire lot would not make a very long article.

Mr. Thomas D. Lockwood, in his article in THE ELECTRICAL WORLD of November 14-21 last, attributes this to the fact that the essential elements that go to make up an electro-mechanical relay or repeater are necessarily few in number, and that consequently few forms are conceivable, or even possible.

This is important, if true, but altogether contrary to my observation and experience, for on giving the matter careful study I found that nothing was easier than to devise a new one every week, all on different lines and appearing plausible and operative enough on paper, but all equally difficult to get results from in practice.

No problem could be more fascinating to the inventor, and none that I have attacked is more elusive and difficult of satisfactory solution. Nearly all the alleged telephone repeaters that have been patented or published I have put into metal with a view of making a thorough investigation of the subject from both the practical and the theoretical side.

Perhaps this work in some instances has not been done with sufficient care or skill, but I have never been able to make any of these supposed repeaters repeat in anything like a satisfactory manner. I have several times abandoned the search as hopeless, reverting to it again, however, from time to time on finding a new or particularly attractive solution of the problem. Of these a dozen or so are of my own invention and fully half as many more were the promising but elusive suggestions of associates or friends.

It will serve no special purpose to multiply instances of these by illustration or description. A few of the more distinct and apparently operative types, however, will be of interest, showing as they do how difficult in these matters it is to determine from a sketch or illustration what will work and what will not. They also serve to show the varied ingenuity that has been expended in this line of invention.

The fundamental idea of a telephone repeater is simple enough and has probably occurred at one time or another to most telephone investigators. The essential feature is to retransmit speech that is received at the end of one line into another, with new battery power, which suggests at once that we must have a new transmitter for the second line that is capable of being actuated in some way by the receiving telephone of the first line, to which speech is sent in the usual way by a transmitter actuated by the voice sound waves at the other end, and so on, if you please, from the second line receiver to a third, and a fourth, or any number.

In regard to the possibility of continuing the repetition indefinitely, I do not know any good reason why numerous repetitions should not be possible of accomplishment if we can only get the first one clear and distinct, "but there is the rub."

The theory of the whole thing is so simple that any tyro in electricity can originate and design a repeater on paper, and few are the experts who can tell him the reason why it won't work, when connected between two lines and speech is addressed to the transmitter of the first.

Figure 1 represents one of these apparently operative devices, but I would suggest that the reader waste neither time nor money trying to make it go, for he will lose both to a certainty.

The figure almost explains itself. The diaphragm of an ordinary receiving telephone is actuated in the usual way, and its vibrations are communicated by a variable microphone contact to a second

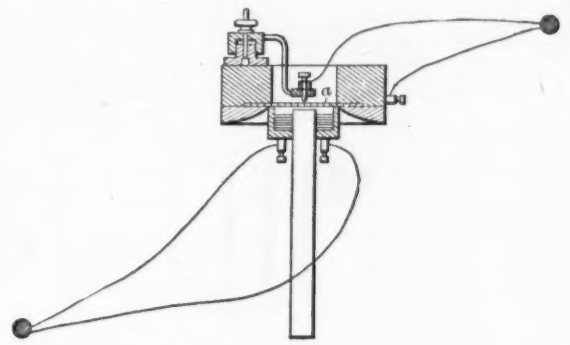


FIG. 1.

battery and line. The repeating microphone parts are shown at *a* in the figure.

It may be said that in this simple device are presented all the essential electro-mechanical elements of a telephone repeater. I don't think such statement, however, is either fair or just; for to me it simply illustrates one of the many cases concerning which we say: "It's all right in theory, but not in practice"—just as if anything could be right in theory that would not work in practice!

The fact is the device is not right in theory, and that is the reason why it cannot work in practice. This device, like many others of the same general description, is altogether too clumsy. In it we have brought together elements that are not equal to the delicate task required of them, they are not sufficiently sensitive in operation to respond to the minute vibrations of a receiving telephone

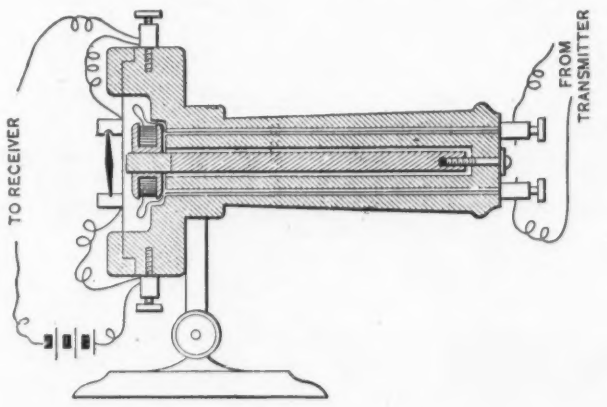


FIG. 2.

diaphragm. That is where the apparently faultless theory is all wrong and the practice consequently fails.

The movement of the diaphragm of a receiving telephone is of the very minutest character, being only a very small fraction of the original movement of the sending or transmitting diaphragm, the latter being actuated by the mechanical beating of the air waves set in motion by the emission of air from the mouth in uttering sound. This is a very much greater force or mechanical power than that of the magnetic vibrations set up at the receiving end of the line, and which alone actuate the diaphragm there.

Again, experiment shows that the slight inertia of the parts at the microphone contact *a*, Fig. 1, is sufficient to kill or dampen the diaphragm movement entirely. Such are the chief reasons why this apparently operative repeater should not be expected to repeat.

The instrument shown in Figs. 2 and 3 are a little better worked out, and certainly look more promising of results. In this one a Hughes microphone composed of delicately suspended carbon pencils is placed on the receiving diaphragm to operate as a retransmitter. I have made this instrument in a variety of forms, taking pains to have the microphone as delicate as possible, but I have never been able to get any repetition from it. Figs. 1, 2 and 3 are identical with those in Mr. Lockwood's article, and I have selected them for illustration again, because they are typical of a great many 'phone repeaters that won't repeat, though I believe they are generally regarded as operative by most electricians, and are patented by the United States Patent Office as operative devices. The difficulties and errors inherent in these simple forms are found in a more or less modified degree in all the patented relays that I have tried.

A few of the more ingenious of these have been selected for description.

Fig. 4 shows the general features of a repeater patented to Mr.

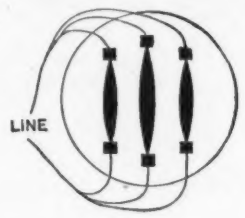


Fig. 3.

Edison, which differs in no material particular from those before referred to. In this one an ordinary receiving telephone magnet is supposed to actuate an armature pivoted on an axis, and having a retractile spring adjustment similar to that of an ordinary telegraph relay. The 'phone magnet is supposed to give the pivoted lever a movement equivalent to that of the varying pulsations of the receiving-phone magnet. The retractile spring pulling on the pivoted lever maintains the carbon microphone points in constant contact, which, of course, should be varied by any movement of the lever. The whole contrivance is absurd; the lever cannot possibly take up any such motion as that of the delicately varying vibrations of the 'phone magnetism; the apparatus is too clumsy in the first place, and in the second place no such pivoted lever could take up such a movement, no matter how delicately it might be poised. To ascertain if such a type could possibly retransmit speech I made a variety of them, with results that might have been foreseen, for the device has all the faults of those previously described, with some added ones peculiar to its own species. A pivoted lever cannot

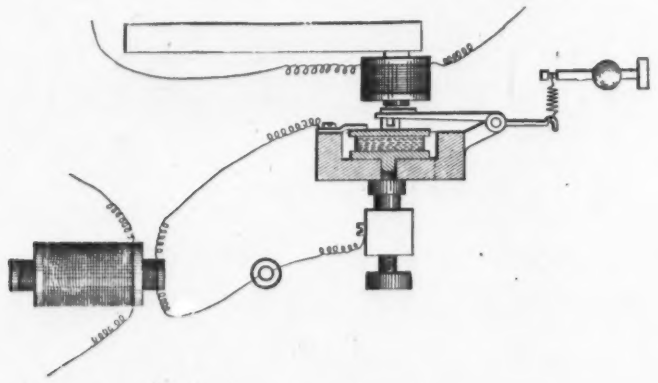


Fig. 4.

possibly take up such a complex movement as that represented by the waves of the electric current of transmitted speech. It is the peculiar and sole property of the circular diaphragm form of armature to a receiving telephone magnet that can follow such delicately and nicely varying fluctuations and give speech vibrations to the air. I believe it is an accepted and settled fact in telephony that reed armatures or stretched steel ribbons cannot take up a complex motion for the reason that they always have a definite and fixed rate of vibration of their own which they always endeavor to follow when set in motion. Much less then could a mere pivoted lever, having not only appreciable inertia, but a fixed centre of gyration, be expected to follow any such delicate fluctuations. In experimenting with instruments of this class, having vibrating reeds or bands, I succeeded in some cases in so increasing the amplitude of vibration that it was plainly visible to the naked eye, but such movement was only in response to magnetic pulsations of a certain period that corresponded to the lever's natural rate of vibration, and which might emit a musical note if rapid enough, but could not produce speech.

Fig. 5 shows another modification of this type. The receiving

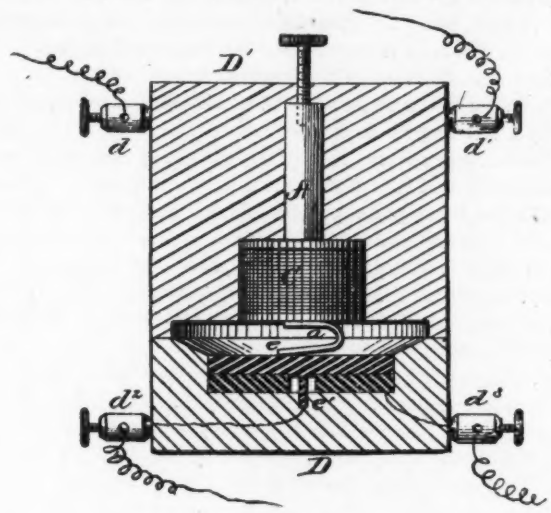


Fig. 5.

telephone diaphragm is provided with a bent spring, *a e*, the other end of which is expected to vary the pressure between the superposed electrodes beneath it in unison with the varying magnetism. This form requires no special criticism. Not only does the bent spring refuse to take up the movement as contemplated, but its pressure against the diaphragm, however slight, checks and destroys the natural motion of the latter, thus rendering repetition impossible.

One of the most ingenious spring armature repeaters is shown in Fig. 6. Through a hollow receiving magnet core a needle is suspended which is made of non-magnetic material, and is provided with a bent spring, 12, at its middle part, and at the outer ends are iron armatures, 8 and 9, held in place by other springs, 10 and 11. These jointly oppose the central spring 12. One of the armatures is provided with a microphone contact in the usual way. We find here evidently an attempt to multiply the amplitude of the original vibration of the receiving diaphragm by means of the triple-spring action.

It is an attractive looking scheme, but here, as before, the springs refuse to take up the movement. Under no circumstances can they

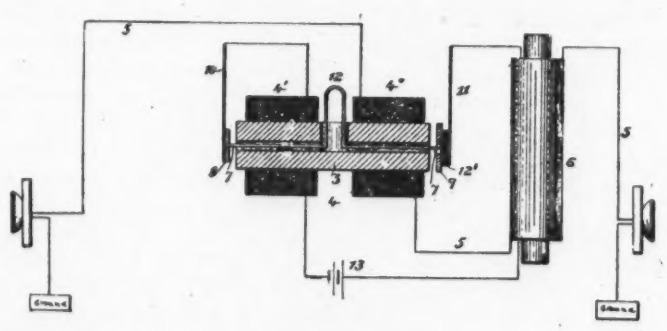


Fig. 6.

move in unison with the delicate vibrations of the speech-transmitting current and resulting magnetism.

The patent on this device contains the usual "go as you please" statement, "that the value of this invention in long-distance telephony is apparent, * * * for by placing one of the relays at an intermediate point where the original current becomes too weak, a fresh impulse can be given it, whereby it can be transmitted to the terminal station or another relay."

Annual Meeting and Dinner of the American Institute of Electrical Engineers.

On Tuesday afternoon, May 18, the American Institute of Electrical Engineers held its yearly business meeting at the rooms of the institute, 12 West Thirty-first Street, President Duncan being in the chair. After the reading of the yearly report by the secretary, votes were cast for the election of the officers of the institute for the coming year. While the votes were being counted by the tellers the discussion of the paper by Professor Crehore and Lieutenant Squier on "The Synchronograph," adjourned from the previous meeting, was reopened. Mr. F. W. Jones, chief electrician of the Postal Telegraph Company, opened the discussion. After a thorough resume of the telegraphic art, both in England and America, in which Mr. Jones tried to show the inefficacy of automatic transmitting systems, the conclusions reached by him were practically that automatic transmitting systems were limited to the transmission of about 165 words per minute; would require twice as many operators to send and twice as many to report the messages. The delivery of the received message in its original form is a matter of great difficulty, and, in fact, almost impossible with the ordinary methods; and as to the possibility of increased traffic, it seems from Mr. Jones' experience that the ordinary Morse system can do more than it gets in regular business, and that with such systems the clerks and operators are about 44 per cent. of the entire maintenance of the system. It seems to Mr. Jones, therefore, that automatic systems are not as desirable as generally expected, owing to the fact that the cost of the tariff which would have to be charged would be far in excess of present methods, owing to the fact of the greater cost of operation, not in transmitting messages, but in preparing and receiving them.

Dr. A. E. Kennelly followed Mr. Jones, stating that he thought that every demand always found its supply, and that if the business of transmission became enormously great, owing to the more rapid means of sending, the telegraph people would be compelled to, and would certainly, find a solution for the expeditious handling of the messages to be transmitted and received at either end.

Following Dr. Kennelly, Mr. Patrick Delany, the well-known inventor of high-speed machine telegraphy, combated many of Mr. Jones' arguments. Speed, he stated, was not the only advantage of the Wheatstone and other machine telegraph systems in use at the present time, but that one of their great advantages and one which had materially aided in their adoption was their extreme accuracy in the transmission of messages. The fact that such European telegraph systems were not profitable was greatly owing to the fact that peculiar relations exist between the various post-office departments in England. As with all innovations of this kind, the first introduction is always beset with many objections from those who are directly interested in the present systems. Mr. Delany most thoroughly believes that the adoption of a machine telegraph system would decrease instead of increase employees. In regard to the paper of Messrs. Crehore and Squier, Mr. Delany was somewhat in doubt regarding the availability and application of the general plan proposed.

Lieutenant Squier answered Mr. Delany by more fully describing the details of the system proposed by him and Professor Crehore, and also stated that the apparatus which was mentioned in the paper was not intended to be a practical one. Professor Crehore closed the discussion by further elaborating on Lieutenant Squier's remarks.

The report of the committee on badges was next read by the secretary. This report was the outcome of a petition signed by various well-known members of the institute, and presented at the late Niagara Falls meeting, requesting that some change be made in the present badge, owing to its lack of dignity and other objectionable features. The committee, which was then appointed, after some deliberation, presented its report, but it was referred to the business meeting of Tuesday. The badge, which has been designed by the committee with the assistance of artists, consists of a square-shaped blue enamel with gold base, the sides of the square being somewhat curved inward. On the blue background are two interlinked gold circles, signifying the interlinking of magnetism and electricity, and in the circles and on the blue base are the letters A. I. E. E. The present report of the committee aroused quite some discussion, which was participated in by Messrs. Duncan, Hammer, Mailloux, Wheeler, Dunn, Emery, Wilcox, Wetzler, Ries, Pupin, Pope and others.

The motion for the acceptance of the committee's report for the adoption of the badge was passed.

By this time the tellers had finished their work of counting the votes that had been cast and announced the election of the following gentlemen, who will act as officers of the institute for the ensuing year: Dr. F. B. Crocker, president; Dr. A. E. Kennelly, C. S. Bradley and Prof. D. C. Jackson, vice-presidents; Ralph W. Pope, secretary; George A. Hamilton, treasurer; Gano S. Dunn, Dr. Alexander Macfarlane, Herbert Laws Webb and Lieut. W. E. C. Hasson, board of managers.

The following associate members were elected: William C. Banks, electrician, Gordon-Burnham Battery Company, 82 West Broadway, New York City; Edward C. Clement, assistant examiner, Electrical Division, United States Patent Office, Washington, D. C.; A. Davidson, cable engineer and electrician, Central and South American Telegraph Company, Lima, Peru; Constant De Redon, consulting engineer, 27 Thames Street, New York City; Sidney Hosmer, superintendent underground cable department, Boston Electric Light Company, Ames Building, Boston, Mass.; Carl Kinsley, teacher of electrical engineering, Washington University, St. Louis, Mo.; John Neilson, superintendent of interior wiring department, Larchmont Electric Company, Larchmont N. Y.; Albert S. Richey, electrician, Citizens' Street Railway Company, 403 West Adams Street, Muncie, Ind.

The following associate members were trasferred to membership: W. W. Nicholson, general superintendent Central New York Telephone & Telegraph Company, Syracuse, N. Y.; R. E. Richardson, electrical engineer, Chicago, Ill.; Edward B. Rosa, Professor of Physics, Wesleyan University, Middletown, Conn.

Following the announcement of the officers for the coming year, the meeting was adjourned for the dinner, which took place at the Arena, almost immediately opposite.

The attendance at the dinner was far in excess of what had been expected, and there were fully 100 covers pre-empted when the toastmaster requested that seats be taken at about half-past seven.

After a repast of prime excellence, the toastmaster, Mr. T. Comerford Martin, announced that there had been selected a list of speakers on topics of current interest, whose elucidation would be certainly watched with eager interest by all present. With many felicitous remarks, Mr. Martin introduced the newly-elected president, Prof. F. B. Crocker, who spoke of "The Institute as I Find It." Following Professor Crocker, and interspersed with more remarks of a most humorous character by the toastmaster, several musical selections by Mr. George H. Guy, whose special composition, "The Electrical Engineers' Waltz," elicited great applause, and also a number of very excellently rendered songs by Mr. C. McL. Payne, came Francis W. Jones, who spoke of "The Ancient Art of Telegraphy;" Dr. Pupin on "Squaring the Electric Circle;" Dr. C. E. Emery, "Niagara for Boiler Feeding;" Dr. A. E. Kennelly, "Electrical Engineering from Port Said to Philadelphia;" R. W. Pope, "Science and Secretaries;" J. W. Lieb, Jr., "Art of Shutting Down Central Stations;" Herbert Laws Webb, chairman of the papers committee of the institute, "The Papers We Don't Get;" Nelson W. Perry, E. M., "The Gasometer from an Electro-Gastronomical Standpoint," and Joseph Sachs, "The Horseless Electrical Press." The selection of the various topics was particularly happy and elicited great mirth and applause.

One o'clock finally came, leaving the participants seemingly fully appreciative of a well-spent evening.

A Large Electric Railway Enterprise in Mexico.

According to a recent dispatch from Cordova, Mexico, the electric railway between that city and Jalapa is approaching completion, 2000 men now being employed on the work. This, it is stated, will be the first electric railway in Mexico, and from the fact that it is 75 miles in length our Mexican friends will have something to be proud of.

Meter Competition.

A prize of $250 was recently offered in Edinburgh for electric meters. Nine competed for the prize and were carefully examined, but none of them were of sufficient merit to warrant the award being made. If these had been gas meters, we could well understand why no award was granted.

Effect of the Berliner Decision.

Below will be found a number of opinions from prominent manufacturers of telephone apparatus, which were received too late to be inserted in our last issue:

Mr. Charles W. Farr, president of the Farr Telephone & Construction Supply Company, Chicago, writes:

"We do not anticipate any serious drawback to the independent telephone companies as a result of the recent decision of the Berliner case. The validity of the patent will have to be determined by a subsequent suit, which must surely result in a victory for the independent companies."

Mr. H. T. Johnson, secretary of the Manhattan Electrical Supply Company, New York, says:

"The decision in favor of the Bell Company was not unexpected by us. The telephone apparatus we have been manufacturing since the expiration of the Graham-Bell patent has been sold with the understanding that we would protect the users. The Berliner patent, as it stands to-day, has by no means the significance that the press is giving it. The Bell Telephone Company is not entitled to protection on this patent. The microphone transmitter is not the invention of Berliner, and we do not consider the patent a valid one. We have made a public offer of $500 to the Bell Company if they would bring suit against us in this State, so that we might be able to properly take care of such a suit."

Mr. James S. Cuming, of the D. A. Kusel Telephone Manufacturing Company, St. Louis, writes us:

"The Bell Company have by this decision purchased a gun which cannot be fitted with cartridges. They will probably use the gun for bluffing purposes, but will not be able to do any injury to those who do not become frightened."

The Northwestern Telephone & Electric Co., Milwaukee, writes:

"The recent Berliner decision in no wise affects our business. We are thoroughly familiar with the situation and practical in the line of telephony, and any suits on the part of the American Bell Telephone Company will result in their defeat. We will continue to sell first-class telephonic apparatus to operate our exchanges as heretofore."

Mr. Josiah Tice, manager of the Lockwood Long-Distance Telephone & Telegraph Company, New Brunswick, N. J., says:

"The effect of the Berliner decision upon our company's business will be to boom the Lockwood transmitter, which being constructed upon the fundamental principle of a 'variable air space' between the electrodes and having its adjustment regulated by tension instead of by pressure, as protected by letters patent No. 528,640 and No. 557,588, issued November 6, 1894, and April 7, 1896, respectively, cannot be affected by any of the claims of the Berliner patent. As to the effects upon the telephone business generally, I believe that the construction and operation of independent exchanges will be continued; the strength and prosperity of the independent companies in the West and Southwest, sustained by the American disposition to favor home rule as opposed to a monopoly having its headquarters afar off, will demonstrate the staying qualities of the independent movement in telephony."

Mr. James E. Keely says:

"My opinion, personally, having been asked upon the recent decision of the Supreme Court, I beg to state briefly: The Supreme Court decision in the Berliner patent case was a victory for the people, and a defeat for the Bell Company, There were four points of contention, any of which might have been a defeat for the Bell Company in case of favorable action. Upon these three points the Bell attorneys fought with all their vigor against adjudication, indicating their absolute fear of the result. If they had had confidence in it they would have brought an adjudication upon all of them. If they had had confidence in any one of them, they would have endeavored to take advantage of it by getting a favorable decision. Their whole effort was to prevent a decision upon any other point than that of alleging fraud upon their part in delaying the issue of the patent. They gained upon this point, but lost upon the three others, for there is hardly a doubt that they could have had an adjudication by the Court of Appeals upon the other points if they had not fought it so severely. Therefore, their fears are substantiated by facts, and taken all in all the farcical litigation between the Bell people and the Government is, in fact, a victory for the people."

The Missouri Telephone Manufacturing Company, St. Louis, writes us:

"We find that this agitation has rather stimulated trade with us, although we have had a number of inquiries relative to the effect of the decision, but it has in no way hurt our business up to date. In fact, we closed a telephone exchange for Seneca, Kansas, the day after the decision was rendered, which goes to prove that Kansas people are not afraid of the Bell Company. Our orders continue to come in for telephone supplies the same as usual."

The Keystone Telephone Company, Pittsburg, Pa., in a letter which it is circulating, says:

"The Court of Appeals did not, nor does the Supreme Court, go into the validity of the Berliner patent. That question has never been decided, and before the Bell Company can get rid of competition it must prove that its patent is a good one. This, we claim, they cannot do. It will take several years to determine this point, and in the meantime the independent telephone movement will go on as before. Should the Bell Company win on the validity of the Berliner patent, the independent companies will have to use the magneto transmitter until the Berliner patent expires. These transmitters will give very good service for distances covered by exchanges at this time, and can be put on telephones now in use at small expense. There is, therefore, nothing to fear in this direction. The situation to-day is the same as it has been for the past three or four years, with the single exception that the charge of fraud has been removed from the Berliner patent. Already arrangements are being made to engage the services of the most eminent patent attorneys in the country to look after the interests of the independent telephone companies. Every step in this matter will be bitterly and thoroughly contested. The independent companies have done too much for the public and are too thoroughly entrenched in public favor to be dislodged. It is the duty of each independent company, therefore, to continue to improve its system, where possible, and to continue to serve the public with superior service as heretofore."

Mr. William L. Marbury, counsel for the Best Telephone Manufacturing Company, Baltimore, gives this opinion concerning the decision:

"I have no idea that the decision will have any practical effect whatever in changing the telephone situation. It will have, of course, one effect, which is always to be regretted, in that it will frighten, for a while, timid holders of telephone stock and cause them to part with it at a sacrifice, but the fact is that no new feature is introduced into the situation by this decision. It is nothing more than an affirmance of a decision to the same effect, rendered by the United States Circuit Court of Appeals from Judge Carpenter, on May 29, 1895, almost exactly two years ago.

"The decision of Judge Carpenter in the United States Circuit Court, in Massachusetts, had been against the Bell Company on the ground that the patent had been obtained by fraud. This decision had been reversed, as already stated, so that the patent for whatever it may have been worth, was in full force and effect from that time, that is to say, from the 29th of May, 1895, and any power or right to control the telpehone situation in this country, which could be based upon the ownership of that patent, has been in the hands of the Bell Telephone Company ever since that time. The Bell Company did nothing, however, and even if this Berliner patent were of any real value it is too late for it to do anything new in the way of suppressing the use of telephones by independent companies. In order to prevent the operation of independent telephone companies, the Bell Company would have to file a bill in a court of equity asking for an injunction to restrain these companies from further continuing the use of their telephones.

"According to perfectly well-established principles of law and equity, the first thing which the Bell Company would have to show would be that it had not been guilty of unreasonable delay in prosecuting offenders against its alleged rights.

"The law requires that the owner of a patent, if he desires to have other people prevented from using it, must take prompt measures to prevent their so doing by giving them warning of his rights, and by promptly instituting legal proceedings to stop them when they neglect his warnings. He has not a right to sit quietly by and allow other persons to invest their money in plants or establishments which require the use of his patent and afterward call upon a court of equity to destroy the value of these investments for his benefit by granting him an injunction. In this particular instance, since the decision of the Court of Appeals two years ago in favor of the Bell Company, that company has seen millions of dollars invested by independent telephone companies in telephone plants

from one end of the country to the other. Several hundred thousand telephones are in full operation in this country in opposition to the Bell Company. If this Berliner patent really gave that company any monopoly, it could have closed all these plants and put a stop to the operation of all these telephones at any time within the last two years. The decision of the Supreme Court does not confer any right whatever upon the Bell Company which it has not had during that whole period. It could not possibly succeed in any attempt to enforce its right against these companies now.

"But the real reason why the Bell Company has done nothing and can do nothing is simply this:

"No telephone has ever been made under the Berliner patent which would work successfully, and none can be made. On the other hand, under the Edison patents, which have now expired, according to the decision of the Supreme Court in the Bate refrigerator case, decided March 4, 1895 (and it is upon the strength of this decision that all the independent telephone companies have been started), perfectly satisfactory telephones can be made, and have been made. It was under this patent that the Western Union Telegraph Company entered the telephone field in 1878 in competition with the Bell Company, and became so formidable a competitor that the latter company was compelled to make terms with it, and on the 10th of November, 1878, entered into an agreement whereby the Western Union was given a large proportion of the royalties as a reward for relinquishing the field to the Bell Company.

Congratulations on the Report of the Berliner Decision.

To the Editor of The Electrical World:

SIR—The able and efficient manner in which you handled the mass of matter relative to the Berliner patent decision is certainly worthy of the honest approbation of the entire electrical fraternity. Permit us to congratulate you.

THE SIMPLEX INTERIOR TELEPHONE COMPANY,
W. L. BRADSHAW, General Manager.

CINCINNATI, Ohio, May 18, 1897.

To the Editor of The Electrical World:

SIR—You are to be complimented upon having gone into the matter of the Berliner decision quite thoroughly in your issue of May 15, and it is pleasing to note that you have placed before the readers of your valuable journal an explanatory description of the Berliner patent that must serve as an educator on a question regarding which many are still in the dark.

How in the world the American Bell Telephone Company can hope to ultimately sustain the Berliner patent is decidedly a question, in view of the fact that the first and second United States Berliner patents have expired, while foreign patents, in which a combination of all his claims are very generally covered, have also expired, which fact alone must of necessity invalidate the United States patent to Berliner of 1891. At least so we infer from the Supreme Court's decision in the now celebrated Bate refrigerator case. Furthermore, I believe, that there is enough evidence now in hand and more to be procured relative to the invention of carbon transmitters prior to Berliner's date of application, sufficient in itself to make it a question of policy with the American Bell Telephone Company as to the wisdom of further offensive or defensive measures in regard to this patent.

THE STANDARD TELEPHONE COMPANY,
J. J. NATE, General Manager.

MADISON, Wis., May 18, 1897.

The Full Text of the Opinion in the Berliner Case.

SUPREME COURT OF THE UNITED STATES.

No. 344.—OCTOBER TERM, 1896.

The United States, Appellant, *vs.* The American Bell Telephone Company and Emile Berliner. } Appeal from the United States Circuit Court of Appeals for the First Circuit.

[May 10, 1897.]

On February 1, 1893, the United States filed in the Circuit Court of the United States in and for the District of Massachusetts a bill in equity against the American Bell Telephone Company and Emile Berliner, praying a decree to set aside and cancel patent No. 463,569, issued on November 17, 1891, to the telephone company, as assignee of Berliner. Upon amended pleadings and proofs the Circuit Court on January 3, 1895, (65 Fed. Rep. 86,) entered a decree as prayed for. On appeal to the Court of Appeals for the First Circuit this decree was on May 18, 1895, reversed, and a decree entered directing a dismissal of the bill (33 U. S. App. 236.) Thereupon the United States took an appeal to this court. A motion was made to dismiss the appeal for want of jurisdiction, which was denied, (159 U. S. 548,) and the case was argued upon the merits.

As stated by counsel for the appellant, four grounds for relief were presented and discussed in the Circuit Court. Those grounds are:

"1. That the delay of the application in the office for thirteen years was, under the circumstances alleged in the bill, unlawful and fraudulent.

"2. That a patent, issued November 2, 1880, upon a division of the original application, covers the same invention as that covered by the patent in suit, and exhausted the power of the Commissioner as to that invention.

"3. That the patent is not for the same invention which was described in the application as filed.

"4. That, taking the application to date from the time when it was made by amendment to cover the invention described and claimed in the patent as issued, it was barred by public use for more than two years."

By that court only the first two were considered, and the argument in the Court of Appeals was confined to those questions.

Mr. Justice Brewer delivered the opinion of the Court.

This is a suit by the United States to set aside a patent for an invention as wrongfully issued. It is, we believe, the first case in this court in which upon proofs such an application has been presented. The right of the United States to maintain such a suit was affirmed in *United States* v. *Telephone Company*, (128 U. S. 315.) The question now is whether upon the facts disclosed in this record the relief prayed for ought to be awarded. It becomes, therefore, a matter of moment to determine under what circumstances and upon what conditions the United States are entitled to have a patent issued in due course of law set aside and canceled.

Many cases have come to this court in which patents for lands have been sought to be set aside, and the rules controlling such suits have been frequently considered. Such decisions will naturally throw light upon the question here presented, though before adverting to them it may be well to note the difference between patents for land and patents for inventions. While the same term is used, the same grantor is in each, and, although each vests in the patentee certain rights, yet they are not in all things alike. The patent for land is a conveyance to an individual of that which is the absolute property of the Government and to which, but for the conveyance, the individual would have no right or title. It is a transfer of tangible property; of property in existence before the right is conveyed; of property which the Government has the full right to dispose of as it sees fit, and may retain to itself or convey to one individual or another; and it creates a title which lasts for all time. On the other hand, the patent for an invention is not a conveyance of something which the Government owns. It does not convey that which, but for the conveyance, the Government could use and dispose of as it sees fit, and to which no one save the Government has any right or title except for the conveyance. But for the patent the thing patented is open to the use of any one. Were it not for this patent any one would have the right to manufacture and use the Berliner transmitter. It was not something which belonged to the Government before Berliner invented it. It was open to the manufacture and use of any one, and any one who knew how could contrive, manufacture and use the instrument. It conveyed to Berliner, so far as respects rights in the instrument itself, nothing that he did not have theretofore. The only effect of it was to restrain others from manufacturing and using that which he invented. After his invention he could have kept the discovery secret to himself. He need not have disclosed it to any one. But in order to induce him to make that invention public, to give all a share in the benefits resulting from such an invention, Congress, by its legislation, made in pursuance of the Constitution, has guaranteed to him an exclusive right to it for a limited time; and the purpose of the patent is to protect him in this monopoly, not to give him a use which, save for the patent, he did not have before, but only to separate to him an exclusive use. The Government parted with nothing by the patent. It lost no property. Its possessions were not diminished. The patentee, so far as a personal use is concerned, received nothing which he did not have without the patent, and the monopoly which he did receive was only for a few years. So the Government may well insist that it has higher rights in a suit to set aside a patent for land than it has in a suit to set aside a patent for an invention. There are weightier reasons why the Government should not be permanently deprived of its property through fraudulent representations or other wrongful means, than there are for questioning the validity of a temporary monopoly or depriving an individual of the exclusive use for a limited time of that whose actual use he claims to have made possible, and which, after such time, will be open and free to all. Bearing in mind this distinction, let us inquire upon what conditions the Government may maintain a suit to set aside a patent for land.

These suits may be conveniently grouped in three classes: First, where, the Government being the only party interested, the patent is charged to have been obtained by fraud in representations or conduct. Second, where the land by appropriate reservation is not subject to patent, but is, nevertheless, erroneously patented. Third, where the land, though subject to patent in the ordinary administration of the land office, is patented to the wrong person either through fraud or by reason of mistake or inadvertence. In the first class are the following cases: *United States* v. *Hughes*, (11 How. 552;) *United States* v. *Throckmorton*, (98 U. S. 61;) *United States* v. *Atherton*, (102 U. S. 372;) *Moffat* v. *United States*, (112 U. S. 24;) *United States* v. *Minor*, (114 U. S. 233;) *Maxwell Land Grant Case*, (121 U. S. 325;) *Colorado Coal* v. *United States*, (123 U. S. 307;) *United States* v. *San Jacinto Tin Co.*, (125 U. S. 273;) *United States* v. *Silver Mining Co.*, (128 U. S. 673;) *United States* v. *Hancock*, (133 U. S. 193;) *United States* v. *Trinidad Coal Co.*, (137 U. S. 160;) *United States* v. *Budd*, (144 U. S. 154;) *San Pedro &c. Co.* v. *United States*, (146 U. S. 120;)—In the second are these: *United States* v. *Stone*, (2 Wall. 525;) *Leavenworth &c. R. R*

Co. v. *United States*, (92 U. S. 733;) *McLaughlin* v. *United States*, (107 U. S. 526;) *Western Pacific R. R. Co.* v. *United States*, (108 U. S. 510;) *Mullan* v. *United States*, (118 U. S. 271;)—and in the third the following: *Hughes* v. *United States*, (4 Wall. 232;) *United States* v. *Beebe*, (127 U. S. 338;) *United States* v. *Marshall Mining Co.*, (129 U. S. 579;) *United States* v. *Missouri &c. Railway*, (141 U. S. 358;) *United States* v. *Southern Pacific R. R. Co.*, (146 U. S. 570.)

The second and third classes are not parallel in this case, for it is not claimed that there was no invention, or that the patent issued to the wrong party. The decisions in those classes need not be considered. The first class comprises all cases in which the land, though subject to patent and therefore within the jurisdiction of the land department, was charged to have been patented in consequence of fraudulent representations or conduct on the part of the patentee. The representations may have been as to the matter of right or the matter of quantity. The patentee may have been entitled to no land, or to less, or a different tract than that patented. In any event, fraud was the basis of the relief sought, and as fraud actual or constructive in the issue of the patent is the burden of this suit, we will quote from the opinions in some of these cases. In the Maxwell Land Grant case, Mr. Justice Miller, delivering the opinion of the court, said (page 381):

"We take the general doctrine to be, that when in a court of equity it is proposed to set aside, to annul or to correct a written instrument for fraud or mistake in the execution of the instrument itself, the testimony on which this is done must be clear, unequivocal and convincing, and that this cannot be done upon a bare preponderance of evidence which leaves the issue in doubt. If the proposition, as thus laid down in the cases cited, are sound in regard to the ordinary contracts of private individuals, how much more should it be observed where the attempt is to annul the grants, the patents, and other solemn evidences of title emanating from the Government of the United States under its official seal. In this class of cases, the respect due to a patent, the presumption that all the preceding steps required by the law had been observed before its issue, the immense importance and necessity of the stability of titles dependent upon these official instruments, demand that the effort to set them aside, to annul them, or to correct mistakes in them should only be successful when the allegations on which this is attempted are clearly stated and fully sustained by proof. It is not to be admitted that the titles by which so much property in this country and so many rights are held, purporting to emanate from the authoritative action of the officers of the Government, and, as in this case, under the seal and signature of the President of the United States himself, shall be dependent upon the hazard of successful resistance to the whims and caprices of every person who chooses to attack them in a court of justice; but it should be well understood that only that class of evidence which commands respect, and that amount of it which produces conviction, shall make such an attempt successful."

In *Colorado Coal Company* v. *United States*, Mr. Justice Matthews, after quoting part of the foregoing. adds (p. 317):

"It thus appears that the title of the defendants rests upon the strongest presumptions of fact, which, although they may be rebutted, nevertheless can be overthrown only by full proofs to the contrary, clear, convincing and unambiguous. The burden of producing these proofs and establishing the conclusion to which they are directed rests upon the Government. Neither is it relieved of this obligation by the negative nature of the proposition it is bound to establish. It is, indeed, sometimes said that a negative is incapable of proof, but this is not a maxim of the law. In the language of an eminent text writer: 'When the negative ceases to be a simple one— when it is qualified by time, place or circumstance—much of this objection is removed; and proof of a negative may very reasonably be required when the qualifying circumstances are the direct matter in issue, or the affirmative is either probable in itself, or supported by a presumption, or peculiar means of proof are in the hands of the party asserting the negative.'"

Then, after quotations from many authorities, the learned Justice closes the discussion with these words from 1 Greenleaf on Ev. sec. 80:

"So, where the negative allegation involves a charge of criminal neglect of duty, whether official or otherwise; or fraud; or the wrongful violation of actual lawful possession of property; the party making the allegation must prove it; for in these cases the presumption of law, which is always in favor of innocence and quiet possession, is in favor of the party charged."

In *United States* v. *Marshall Mining Company*, Mr. Justice Miller again refers to this matter, saying (p. 589):

"The dignity and character of a patent from the United States is such that the holder of it cannot be called upon to prove that everything has been done that is usual in the proceedings had in the land department before its issue, nor can he called upon to explain every irregularity or even impropriety in the process by which the patent is procured."

With these declarations of the law controlling such cases we proceed to consider that which, according to the brief of counsel for the Government, is the principal matter in this case. We quote their words:

"The delay in the office is the great fact in the case. It determined the bringing of the suit, stands in the forefront of the bill, was the principal question argued in both courts below, and occupies the chief space in the decisions rendered. It is not set up as laches, nor as a ground of forfeiture under any provision of the law or rule of the Patent Office, but as a course of conduct in the nature of fraud on the public."

What was the delay in this case? The application by Berliner was made on June 4, 1877, he having filed a caveat on April 14, 1877. In 1878, and prior to October 23, the telephone company purchased Berliner's invention, and on November 17, 1891, a patent was issued to the telephone company, as assignee of Berliner. The application was, therefore, pending in the department fourteen years, during thirteen of which the invention was the property of the telephone company. The effect of this, it is said, is to prolong for all practical purposes the telephone monopoly during the lifetime of this patent; and in this way: On March 7, 1876, patent No. 174,463 was issued to Alexander Graham Bell, in which patent, as alleged in the bill and admitted in the answer, were described and claimed "a method of and apparatus for transmitting sound by means of an undulatory current of electricity." This was the original telephone patent. And it signified that Bell invented the telephone. That patent has expired and all the monopoly which attaches to it alone has ceased, and the right to use that invention has become public property. But while he invented the telephone, the apparatus he devised was inefficient for public uses. Berliner invented something by which, taken in connection with Edison's and Blake's inventions, Bell's undulatory current could be made practically available for carrying on conversation at long distances. In other words, the telephone, as we use it—that which has become such an important factor in the commercial and social life of to-day—does not embody simply the invention of Bell, but also those of Edison, Blake and Berliner. So that while the public has to-day, by reason of the expiration of the Bell patent, the right to use as it pleases his invention, such right is a barren one, and the telephone monopoly is practically extended to the termination of the Berliner patent. And this extension of the time of the monopoly has been accomplished by means of the delay in the issue of the Berliner patent, the long pendency of the application in the Patent Office. In order that the contention of the Government may be clearly presented, and in view of the importance of this question, we may properly quote at some length from the brief of counsel:

"In the present case Mr. Bell's patent of 1876 covered broadly the process of transmitting sound by means of an undulatory electric current, as distinguished from an interrupted or broken current, no matter how produced. His patent showed a transmitter capable of producing such a current, but so feebly that its use was limited to short distances. Afterwards Mr. Berliner discovered, we will say, that the undulatory current necessary to transmit speech can be produced by means of another form of transmitter—one operating by variation of pressure between its electrodes at their point of contact. But as the only function of the instrument was to produce an undulatory current, and as the use of that current, however produced, was covered by Mr. Bell's invention, it follows that the instrument was subject to two independent monopolies.

"Later, we will say, Mr. Edison discovered that the use of carbon as the material for the construction of the electrodes of the Berliner transmitter gave to that instrument a greatly increased power and reach of operation. Later still Mr. Blake devised a particular combination of carbon and metallic electrodes, with mechanism for their mounting, which secured an improved ease and permanence of adjustment and superior adaptation to common use. Mr. Bell hit upon the true principle, in relation to the kind of current to be employed, and was justly entitled to a patent for it, although the range of his transmitter may have been but a few hundred feet. Mr. Berliner, we will say, hit upon the true principle underlying the operation of the microphone, and was entitled to his patent, although the mechanism he used in the embodiment of his thought was so unstable in its adjustment as to make it of uncertain value. The inventions of Mr. Edison and Mr. Blake completed the instrument, and made possible the talking telephone in every man's house, the city exchange, and the long-distance line from city to city.

"It thus happened that the Blake transmitter introduced into public use by the Bell Company in 1878, and familiar to us all, was the embodiment in one piece of mechanism, and its use of four distinct inventions made by four different men. That company was the owner of all the inventions. For Mr. Bell's invention it held patents issued in 1876 and 1877; for Mr. Blake's patents were issued in 1881; and for the others, applications were on file subject to its control.

"Mr. Bell's invention was one of the first rank—nothing less than the discovery of a new law of nature. Mr. Berliner's invention was a beautiful intellectual conception of a mode of operation. Mr. Edison's was the discovery of a new property of carbon. Mr. Blake's was an ingenious and a practical utilization of the three. Mr. Bell's invention lies at the foundation of the art of telephony. Mr. Edison's and Mr. Blake's have done more to make the art of practical value than all others following Mr. Bell.

"We assume that it was not possible to take out patents for all these inventions at the same time. And so far as that was not possible, the overlapping and prolongation of the monopolies created by the patents in the use of the carbon microphone could not be avoided without denying to some one or more of the inventors his rights under the law. But does it follow that the Bell Company was entitled of right to hold control of the microphone under the broad claims of the Bell patent and the construction and combination claims of the Blake patents, and nurse the applications for the other inventions in the office, taking out a patent on Berliner's just in time to overlap Bell's, and on Edison's in time to overlap Berliner, and so secure a monopoly on the same transmitter used in the same way to produce the same result for three times the period fixed by the statute for the duration of a patent?

"It needs no lawyer's argument to make manifest the inherent moral wrongfulness of such a proceeding toward the public. Every right-minded man will feel it instinctively. Would it be a legal wrong?"

After discussing the injury to the public which results from the conduct described, they add:

"Hence a man who is enjoying a monopoly of a thing under one patent, and is at the same time prosecuting an application for another patent which will give him a monopoly of the same thing for a further period, is bound to speed his application."

It will be perceived that it is conceded that some delay is unavoidable. In the very nature of things that is so. It is not possible that an application for a patent can be considered and determined on the instant. So it is not the fact, but the excessiveness of the delay of which complaint

is made. The mere fact of delay does not, therefore, operate to deprive the inventor of his legal rights. Before he can be punished it must be shown that he has been guilty of a wrong—that he has caused the delay. It matters not whether the delay be reasonable or unreasonable, for a brief time or for many years, if the applicant is not responsible for it. Whatever may be the injury to the public, if the delay is caused solely through the negligence or inattention of the tribunal before which the application is pending, it is something for which the applicant is not responsible, and which does not affect his legal rights. There is often great delay in suits in the courts. Cases not infrequently are argued before the highest courts and not decided by them for weeks and sometimes for years. Whatever effect such delay may have upon the interests of others or of the public, so long as it results from the mere non-action of the courts, the rights of the suitor are unaffected. He cannot be punished on account of the delay of the tribunal before which he is presenting his suit.

Neither can a party pursuing a strictly legal remedy be adjudged in the wrong if he acts within the time allowed, and pursues the method prescribed by the statute. If the statute gives him five years within which to bring an action on a note he cannot be denied relief simply because he waits four years and eleven months. If he has two years after a judgment against him within which to take an appeal he may wait until the last day of the two years. Under section 4886, Rev. Stats., an inventor has two years from the time his invention is disclosed to the public within which to make his application, and unless an abandonment is shown during that time he is entitled to a patent, and the patent runs as any other patent for seventeen years from its date. He cannot be deprived of this right by proof that if he had filed his application immediately after the invention the patent would have been issued two years earlier than it was, and the public therefore would have come into possession of the free use of the invention two years sooner. The statute has given this right, and no consideration of public benefit can take it from him. His right exists because Congress has declared that it should. It will not do to say that, because Congress has declared that seventeen years is the life of a patent, seventeen years is the limit of the possible monopoly; for the same legislation that gives seventeen years as the life of a patent gives two years within which an application for a patent may be made, and during that time, as well as while the application is pending in the department, the applicant has practically if not legally, an exclusive one. A party seeking a right under the patent statutes may avail himself of all their provisions, and the courts may not deny him the benefit of a single one. These are questions not of natural but of purely statutory right. Congress, instead of fixing seventeen, had the power to fix thirty years as the life of a patent. No court can disregard any statutory provisions in respect to these matters on the ground that in its judgment they are unwise or prejudicial to the interests of the public.

And in this connection it is also well to notice these facts: Sec. 4888, Rev. Stat., requires an inventor to make application in writing to the Commissioner of Patents. That and the two or three succeeding sections prescribe what the application shall state, and by what it shall be accompanied. Section 4893 provides that on the filing of the application and the payment of fees "the Commissioner of Patents shall cause an examination to be made of the alleged new invention or discovery; and if on such examination it shall appear that the claimant is justly entitled to a patent under the law, and that the same is sufficiently useful and important, the Commissioner shall issue a patent therefor." Section 4894 reads:

"All applications for patents shall be completed and prepared for examination within two years after the filing of the application, and in default therefor, upon failure of the applicant to prosecute the same within two years after any action therein, of which notice shall have been given to the applicant, they shall be regarded as abandoned by the parties thereto, unless it be shown to the satisfaction of the Commissioner of Patents that such delay was unavoidable."

Certain rules of procedure have been prescribed by the Commissioner of Patents, and a certain routine of practice has become established in that department. Now, all these matters of statutory enactment, rules of procedure and routine of practice, are things over which an applicant has no control. When he has once filed his application, complying with the statutory requirements, then the Patent Office takes possession of the matter. It determines when and how it will act, and the applicant can only ask and wait.

And why should he be called upon to do more? He comes before the tribunal which the Government has established and presents his application. Why should the validity of the grant which that tribunal finally makes depend in any degree upon the number of times he has repeated his application? The true rule is that if application has been made and the applicant has once called for action, he cannot be deprived of any benefits which flow from the ultimate action of the tribunal, although that tribunal may unnecessarily, negligently, or even wantonly, if that supposition were admissible, delay its judgment. If the public is interested in prompt action, if the Government which represents the public thinks that more speed on the part of any of its tribunals is essential, it is the Government which is called upon to act, and the applicant may with propriety wait until either the tribunal has acted or until the Government, having regard for the public interest, has interfered to compel action. Accepting the statement of counsel as to the facts to be correct in all its fulness, consider what would have been the ruling of a court if an application had been made to it based upon those facts. Suppose the applicant had presented its petition for a mandamus to compel prompt action on the part of the patent officials and said, "I have applied for and am entitled to a patent. It will be issued after a while without any judicial compulsion. I can make large profits if the Patent Office will be dilatory, and yet I ask a mandamus to compel its immediate action," would not the ruling have been, "By your own showing you are entitled to no relief; you have no cause of complaint; it is the Government, representing the public, which alone can complain." And if it could obtain no assistance by a suit in advance, can it be punished indirectly by being deprived of that which was finally awarded to it?

Much is said in the briefs and in the arguments about the practical continuance of the telephone monopoly. It is well to understand exactly what is meant thereby. No one questions that the Bell patent has expired, and that all of his invention is free to the use of the public. It is not denied that Berliner's invention is something independent and distinct from the Bell invention. It is the combination of these inventions with those of Blake and Edison which make the instrument in commercial use, and because this is the most serviceable it is the one that the public insists upon having. But each invention has independent rights. It loses nothing because when united with another it results in an instrument more valuable than either alone will give. Suppose that at the expiration of this Berliner patent some new invention shall be made by which in connection with those already free to the public an instrument can be manufactured far surpassing in utility that used to-day, and the Bell Company shall purchase that invention, the public, which always insists on having the best and most serviceable, will undoubtedly take the new instrument, and in that way it may happen that what is called the telephone monopoly is practically still further continued. But surely that does not abridge the legal rights of any one. The inventor of the latest addition is entitled to full protection, and if the telephone company buys that invention it is entitled to all the rights which the inventor had. All that the patent law requires is that when a patent expires the invention covered by that patent shall be free to every one, and not that the public has the right to the use of any other invention, the patent for which has not expired, and which adds to the utility and advantage of the instrument made as the result of the combined inventions.

Counsel seem to argue that one who has made an invention and thereupon applies for a patent therefor, occupies, as it were, the position of a quasi trustee for the public; that he is under a sort of moral obligation to see that the public acquires the right to the free use of that invention as soon as is conveniently possible. We dissent entirely from the thought thus urged. The inventor is one who has discovered something of value. It is his absolute property. He may withhold the knowledge of it from the public, and he may insist upon all the advantages and benefits which the statute promises to him who discloses to the public his invention. He does not make the law. He does not determine the measure of his rights. The legislative body, representing the people, has declared what the public will give for the free use of that invention. He cannot be heard in the courts to say that it is of such value that he is entitled to a larger and longer monopoly; that he is not fully compensated for the great benefit which his invention has bestowed by the pecuniary receipts during seventeen years. No representative of the public is at liberty to negotiate with him for a new and independent contract as to the terms and conditions upon which he will give up his invention. He must come under the dominion of the statute, and take that which the public has proffered its willingness to give. As the lawmaking power has prescribed what the public will give, specified the terms and conditions of purchase, indicated the time and methods of determining the right of compensation, he on his part has an absolute legal right to avail himself of all the provisions thus made. It is not, of course, doubted that the courts in construing the patent as all other statutes, must have regard to the spirit as well as the letter. That simply requires that courts shall ascertain their true meaning, but when that is ascertained the applicant for a patent is entitled to all the benefits which those statutes thus construed give.

What are the evidences of wrong in this matter of delay? It may have been caused either by the negligent or wrongful action of the officers of the department, and without any connivance, assistance or concurrence on the part of the applicant, or it may have been brought about by the applicant, either through its corruption of the public officers, or through other misconduct on its part. If the fault is wholly that of the department, the applicant ought not to suffer therefor. While, on the other hand, if its conduct has been wrongful, it may and ought to suffer. There is no presumption against the applicant. If a tribunal charged with official action delays such action, whatever of presumption surrounds the delay attaches to the tribunal, and no evidence of wrong being given, the presumption would be that the delay was at the instance of the tribunal and not caused by the applicant. The Government, therefore, in order to make out its case, must affirmatively show that the delay has been caused in some way by the conduct of the applicant, and before its patent can be set aside the Government must, in accordance with the rules laid down in respect to land patents, establish that fact clearly. It may not rest on mere inferences, mere suggestions, but must prove the wrong in such a manner as to satisfy the judgment before it can destroy that which its own agents have created. We reiterate what was said by Mr. Justice Miller, for the court, in the Maxwell Land Grant case, that a suit between individuals to set aside an instrument for fraud can only be sustained when the testimony in respect to the fraud is clear, unequivocal and convincing, and cannot be done upon a bare preponderance of evidence which leaves the issue in doubt; and that if this be the settled rule in respect to suits between individuals it is much more so when the Government attempts to set aside its solemn patent. And we may here again repeat that if this is true when the suit is to set aside a patent for land, which conveys for all time the title, a fortiori it must be true when the suit is one to set aside a patent for an invention which only grants a temporary right.

What evidence has the Government produced? We premise by saying that there is not a scintilla of testimony as to any corruption of the officers of the department by the defendants, or any attempt at such corruption. Counsel do not put the finger on a single fact tending to show that any money was ever paid to any official of the Patent Office, or that any undue influence was ever attempted to be exerted upon or improper suggestion made to any one. So far as the record discloses, there never was an intimation made to a single official that he could profit in any

way by a moment's delay. All thought of wrong in this respect may, therefore, be put aside. If there was no corruption on the part of the defendants, what did they do that calls for condemnation? And we turn to the brief of the learned counsel for the Government to see what evidences of wrong they have found in the record. After noting that their inquiry begins at June 9, 1882, thus implicitly conceding that there is no reason to question the delay up to that time, (a period of five years,) they call attention to the subsequent correspondence between the solicitor in charge of the application and the officials of the department, which, so far as is material, is as follows:

"On June 9, 1882, the examiner wrote to the solicitor as follows:

'As at present advised it is believed that the claims presented may be allowed, but final action in this case must be suspended in view of probable interferences with other pending applications, which will be declared as soon as practicable.'

"On October 8, 1883, sixteen months later, the solicitor wrote as follows:

'In June, 1882, I received an official letter dated the 9th of that month, saying that "the claims presented may be allowed, but final action is suspended in view of probable interferences." Since then I have been awaiting the official action. I beg to call attention to the case and ask that it may receive action.'

"October 23, 1883, the examiner, as follows:

'In response to applicant's letter filed October 9, 1883, it is stated that further action in this case on the part of the office must be still further postponed until the conditions of interfering applicatons will permit the declaration of interference, which seems unavoidable.'

"On February 19, 1886, two years and four months later, the solicitor, as follows:

'The specification is hereby amended as follows: Erase amendment O, filed December 16, 1881: Erase claims 3, 7, 8, 10 and 11, and change number of claims 4, 5, 6, 7 and 9 to 3, 4, 5, 6 and 76.'

"This amendment contained nothing material to the present discussion.

"March 17, 1886, the examiner, as follows:

'In response to amendment of February 19, 1886, applicant is advised that the broad claims involving the idea of a variable pressure contact telephone will probably be involved in an interference with a pending application or applications of another applicant, and that said applicant has been advised that he must show that the office action taken in the matter of his application is not a sufficient answer thereto on or before the 1st of April, 1886. In the meanwhile this application will be suspended from further action.'

"August 13, 1886, five months later, the solicitor:

'I desire to be informed of the present status of this case, and to be advised if the office is awaiting any action on the part of the applicant. It is desired that no rights should be lost by inaction.'

"August 19, 1886, the examiner, as follows:

'In response to applicant's letter of the 13th inst. he is hereby advised that the delay in this case is a matter over which he has no control, except it be, perhaps, in the matter of urging an early interference. The interference will be declared as soon as the other applicants are in condition, if it be decided that they are entitled to the same. The office is awaiting no action on the part of the applicant, and the delay is through no fault of his.'"

After these quotations counsel observe as follows:

"These perfunctory exchanges of compliments between the solicitor and the examiner occupied the entire time from June 9, 1882, to March 16, 1888, five years nine months and seven days. In all that time not a demand for action, not a hint even of dissatisfaction, appears in the record. We have quoted it all. Of course, this appearance of willing acquiescence is not conclusive. The examiner's letters indicate an obstacle in the way; some portending interference or interferences, always coming, yet never arriving. But the supine submission of the company to such extraordinary delay, for such a cause, is the first item of the proof. If it had been possessed of a real purpose to have its patent as soon as possible, if it had been losing millions per annum for want of it, as the people are losing millions because of it, would it not have found some way to force this invisible foe into the field, or at least leave on the record some trace of its mighty effort to burst the bands of official routine which prevented it from finding and fighting him?"

This presents the burden of the case on the part of the Government. It amounts to only this: The defendant company was not active but passive. If millions were to be added to its profit by active effort it would have been importunate and have secured this patent long before it did. As millions came to it by reason of its being passive, it ought to suffer for its omission to be importunate. It must keep coming before the Commissioner, like the widow before the unjust judge in the parable, until it compels the declaration, "though I fear not God nor regard man, yet, because this widow troubleth me, I will avenge her, lest by her continual coming she weary me." But is this the rule to measure the conduct of those who apply for official action? What is the amount of the importunity which will afford protection to the grant finally obtained? How frequent must the demand be? It is easy to say that the applications of this defendant, coming only at the interval of months and years, were, taken with the replies of the Patent Office, mere "perfunctory exchanges of compliments," but this does not change the fact that action was asked and repeatedly asked; that no request was made for delay, no intimation that it was desired or would be acceptable.

In this connection may well be noticed the letter of the solicitor, in March, 1881, to the Commissioner, in which he urged the modification of Rule No. 94 in respect to interferences, and this in order to hasten the issue of the patent. In this letter, besides pointing out how the rule as it then existed would tend to delay, he adds these statements:

"So far as my client is concerned, I have to submit that it is of the utmost importance that the interference be declared forthwith. . . .

"The indefinite suspension of the interference would only create harassing and oppressive claims after the public had become possessed of the invention without hinderance or objection on the part of the inventor, and it is but just to say that neither of the interfering applicants could with any degree of propriety claim to be the inventor and expect that such notice on his part would be treated by the public with any degree of respect. Patents issued as the result of long pending interferences are always looked upon as odious monopolies because of the manner in which they are enforced at the time the public were already possessed of the invention. . . .

". . . An early decision upon the question submitted is earnestly requested."

It may be added that the modification was made in October, 1881.

In respect to this letter, and especially the second paragraph, quoted above, counsel for the Government say:

"In the argument below, counsel appeared to think that once was enough, and that they stood as a perpetual exhortation to duty to the examiner and all his successors as though they had been nailed on his office door. But they were not even in the file of the Berliner case. Examiner Freeman, whose report was endorsed on the letter, went out of office in 1883. If any one ever saw it after that until it was exhumed for the purpose of this case, the fact does not appear in the record."

But is the applicant to be condemned because, having once made an urgent request for action and pointed out reasons therefor, it was not continually repeating that request, because it did not see that such request was placed on the files of this particular application, or, as intimated in the words of counsel, nailed on the doors of the Patent Office?

It is, of course, easy to say that these applications, these suggestions and requests meant nothing; that they were a mere blind; but something more than assertion of counsel is necessary to destroy their significance, or to establish collusion between the applicant and the officials of the department. But the case does not stand upon the fact that the formal communications from the solicitor in charge of this application were few in number. While in every one, in which the matter was referred to, there was a request for action, it also appears from the testimony of Messrs. Freeman, Lyons and Kintner, who were the examiners in charge during the major portion of the time in dspute, that the representatives of the Bell Company were urgent in pushing the Berliner application. For instance, Examiner Lyons testified:

"They were urgent and persistent beyond toleration. Hardly a day passed without somebody representing the interests of the Bell Telephone Company coming to our room and urging the allowance of the Berliner case, or the declaration of interferences. I myself was waylaid in the halls of the Patent Office, and on more than one occasion did I sneak into the room to avoid being bored by Mr. Charlie Hedrick, the assistant of Mr. Pollok. Mr. Pollok himself, also, although less frequently, came to the room, and later on, notably toward the end of 1884, and in the spring and summer of 1885, Mr. W. W. Swan was a frequent visitor in the electrical division."

And Examner Kintner, (who was in office from May, 1883, to April, 1887,) in reply to a question as to what Mr. Swan, one of the representatives of the telephone company, did in respect to the application, said:

"I had a great many interviews with him in the matter of both the Edison and the Berliner applcations under consideration, and he was very persistent in urging the passage of both applications to patent; in fact, to such an extent that his persistency annoyed me not a little."

Another matter referred to by counsel is what they call the "tacit understanding." The facts are these: One Daniel Drawbaugh claimed to have invented the telephone prior to Bell. He assigned his inventions to the People's Telephone Company, between whom and the defendant company a heated and protracted litigation arose. Now, it is said that there was an agreement, or, at least, a tacit understanding, between the officials of the Patent Office, the People's Company and the defendant company that the proceedings in the Patent Office in respect to the Berliner application should wait the determination of the litigation between the two telephone companies. It is insisted that the officials had no right to enter into such an agreement; that it was unlawful in its character. Assuming that this is so, still the fact appears that the proposition therefor came from the representatives of the Drawbaugh interest, that it was deemed by the officers of the Patent Office to be for the best intersts of all, and that it was simply assented to by the defendant. Nowhere does it appear that the defendant urged, or even suggested, the propriety of such a delay. For the present we do not consider the wisdom or the rightfulness of the course pursued. All that we desire to notice is that it was not at the instance of the defendant.

It is further said that, even if there were at first any excuse for such "tacit understanding," and the Patent Office properly delayed action on this application until after the litigation between Drawbaugh and Bell had ended, a judgment therein was rendered in the Circuit Court in 1884; and that then the office should have proceeded promptly, and that there was no excuse for waiting until the decision of the appeal by this court in 1888; and least of all for any delay after that final decision by this court.

Summing up their argument on this branch of the case counsel say:

"The review of the history of the Berliner application which we have now completed shows that in its treatment of it the office proceeded upon two unlawful assumptions.

"The first was that an applicant, whose application is ready for issue except for a possible threatened interference, must wait until the antagonizing application is either found allowable and ready for the interference, or finally ejected from the office, no matter how long that may be. This assumption governed the action of the examiners from 1882 to the issue of the patent. . . .

"The second assumption was that the judicial determination of the question of Drawbaugh's invention, in the suit between the owners of the applications,

was not enough to warrant action by the office. Examiner Kintner took the ground, in conversation with Mr. Swan—never on the record—that the decision of the Circuit Court was not enough for him; that the case might be appealed, and he would act only on the decision of the Supreme Court. But when that came, it received no more consideration than had been given to that of the Circuit Court."

Were it conceded that these two assumptions were "false assumptions," as counsel call them, what are they but errors of judgment on the part of the patent officials as to the course of procedure; and can it be possible that an applicant for a right, who has under the statute no choice of tribunals or course of procedure, but is compelled to apply to one tribunal which has exclusive jurisdiction in the matter, and must abide by its rulings as to procedure, can be held to have forfeited his right simply because of errors of judgment by such tribunal as to the procedure? The statement of the question seems to us to carry its own answer. It is true counsel follow this declaration of the errors on the part of the office in the matter of procedure with the further statement:

"The guilty party is the Bell Company. It had a full and perfect inside view of the whole situation from the beginning. Its attorneys were wiser in these things than the commissioners or the examiners. They shrewdly availed themselves of every unauthorized usage, mistaken assumption, ignorant misconception, or supposed obstacle, by means of which the issue of the patent could be delayed without apparent responsibility on their part. In view of the duty which vested upon the company to speed the application, that was fraud, not less but more reprehensible because it was not of the common and gross kind, but so refined and acute that its garb of professed innocence has deceived even the Court of Appeals."

The difficulty with this charge of wrong is that it is not proved. It assumes the existence of a knowledge which no one had; of an intention which is not shown. It treats every written communication from the solicitor in charge of the application, calling for action, as a pretense and all the oral and urgent appeals for promptness as in fact mere invitations to delay. It not only rejects the testimony which is given, both oral and written, as false, but asks that it be held to prove just the reverse.

Indeed, the case which the counsel present to us may be summed up in these words: The application for this patent was duly filed. The Patent Office after the filing had full jurisdiction over the procedure; the applicant had no control over its action. We have been unable to offer a syllable of testimony tending to show that the applicant ever in any way corrupted or attempted to corrupt any of the officials of the department. We have been unable to show that any delay or postponement was made at the instance or on the suggestion of the applicant. Every communication that it made during those years carried with it a request for action, yet because the delay has resulted in enlarged profits to the applicant, and the fact that it would so result ought to have been known to it, it must be assumed that in some way it did cause the delay, and having so caused the delay ought to suffer therefor. There is seldom presented a case in which there is such an absolute and total failure of proof of wrong.

The defendant company might safely have left the case here, but it has not been content to rest the controversy with the failure on the part of the Government to show any wrong. It has not been content to accept the Scotch verdict of "not proven." It has called as witnesses the examiners who were in charge of this application, and taken their testimony as to what did in fact take place, and as to how and why the long delay occurred. Whatever judgment may be pronounced upon the wisdom of the course pursued by these officials, or the sufficiency of the reasons given by them therefor, there is no ground for controverting that they acted in good faith. The case is not one of arbitrary, peremptory postponements and delay.

They supposed they were acting in compliance with the rules of the Patent Office, and out of proper regard for the rights of conflicting interests. No just estimate can be placed upon the propriety of their conduct without taking into consideration the whole subject of telephonic inventions and litigation. As heretofore stated, and as is well known, Bell claimed to be the pioneer in this matter of telephonic communication. His claim was disputed, and out of that dispute came the most important, the most protracted litigation whch has arisen under the patent system in this country. For years this litigaton was pending in the trial courts, subsequently brought to this court, and finally decided in 1888. So great was this litigation, so immense the volume of testimony, and so important the rights involved, that it is the only case in the history of this court to which an entire volume of our reports is devoted. (126 U. S.) The argument was protracted through weeks, and the case was held under consideration for a year, and finally decided by a closely divided court. Is it strange that, when the primary right was being so vigorously contested, and was so much a matter of doubt, when (as appears from the testimony in this case) the judgment of the law department of the Government was adverse to the claims of Bell, and to the validity of the patent which he had obtained—is it strange, we ask, in view of these facts that the disposition of the apparently minor matter should be held in abeyance in the Patent Office until a final decision of the primary right?

Neither can any just estimate be placed upon their conduct without taking into account the volume of business, and the pressure on account thereof, in the Patent Office. Beyond the fact, which is a matter of common knowledge, that thousands of applications are filed and thousands of patents granted each year, the record discloses something as to the multitude of applications for patents for telephones and telephonic devices which were pending during these years. Mr. Townsend, who was an examiner up to November 15, 1880, while unable to state the number of applications, was able to say that he had examined over 120 that went to patent. This it will be remembered was in the early days of telephonic investigation and invention. It appears also from a communication made by the Commissioner of Patents to the Secretary of the Interior, on December 13, 1892, advising against this suit, that at that time a gentleman, who is called in the letter the "relator," had pending in the Patent Office 152 applications for patents on telephones and telephone systems. These facts may be only side lights, but they show that the examiners and other officials in the Patent Office had something else to do besides considering this application.

Of course, it is easy to say that the Patent Office could have disposed of this application more promptly than it did; that it ought to have done so, and that, in view of the termination of the great litigation favorable to the claims of Bell, its delay has resulted in large pecuniary benefits to the defendant. But a wisdom born after the event is the cheapest of all wisdom. Anybody could have discovered America after 1492. The question is not whether a better judgment on the part of the patent officials would have disposed of this application long before it was, is not indeed whether there was any error of judgment, but whether they acted wrongfully and their action was induced by or at the instance of the defendant.

One thing more deserves notice. The argument of the counsel for the Government proceeds all along on the assumption of the superior knowledge of the representatives of the defendant company; that they saw the end from the beginning; that they know that their client had an invention which was patentable and that they would ultimately obtain a patent therefor, and also that Bell was and would finally be adjudged the primary inventor of the telephone, and that possessed of all this knowledge they planned the delay in securing the Berliner patent in order that thereby they might extend to the termination of its life the telephone monopoly. But what an assumption this is, and how illy justified by the facts! The very process and termination of the Bell-Drawbaugh litigation demonstrates the doubtfulness of the question there in issue, and is absolute evidence that there was up to the close of that litigation an uncertainty as to the result. Equally uncertain was the outcome of the Berliner application. Indeed, there is an uncertainty as to every application. No one can foretell what will be the judgment of the Patent Office upon the questions of novelty and utility. And in respect to this Berliner application the matters which are subsequently to be considered attest that there was more than ordinary doubt as to the outcome. On account of those matters it is earnestly contended that there was no merit in the application, and that it ought to have been denied. Further than that, they knew that the officials of the Patent Office were subject to change—as in fact they were changed during the pendency of these proceedings—and even if they had any direct intimations from the first examiner or the first commissoner, there was no certainty that a subsequent examiner and subsequent commissioner would entertain the same views. If the Bell-Drawbaugh litigation had terminated the other way and a different opinion on the part of a single member of this court would have changed this result, or if when the time came the Commissioner of the Patent Office had decided against the Berliner application, and his decision been sustained on appeal to the Supreme Court of the District of Columbia, then all this brilliant scheme of realizing millions would have vanished into thin air. If they were possessed of the wisdom which the Government attributes to them, the representatives of the Bell Company must have realized that the certainty which attends a final decision and the issue of a patent was something worth striving for, and not lightly to be ignored. And if this underlying assumption has so little foundation, what shall be said of an inference and an imputation unsupported by evidence and based upon that assumption?

Our conclusions on this branch of the case are: First, that before the Government is entitled to a decree cancelling a patent for an invention on the ground that it had been fraudulently and wrongfully obtained, it must, as in the case of a like suit to set aside a patent for land, establish the fraud and the wrong by testimony which is clear, convincing and satisfactory. Second, that Congress has established a department with officials selected by the Government, to whom all applications for patents must be made; has prescribed the terms and conditions of such applications, and entrusted the entire management of affairs of the department to those officials; that when an applicant for a patent complies with the terms and conditions prescribed and files his application with the officers of the department he must abide their action, and cannot be held to suffer or lose rights by reason of any delay on the part of those officials, whether reasonable or unreasonable, unless such delay has been brought about through his corruption of the officials, or through his inducement, or at his instance. Proof that they were in fault, that they acted unwisely, unreasonably, and even that they were culpably dilatory, casts no blame on him and abridges none of his rights. Third, the evidence in this case does not in the least degree tend to show any corruption by the applicant of any of the officials of the department, or any undue or improper influence exerted or attempted to be exerted by it upon them, and on the other hand does affirmatively show that it urged promptness on the part of the officials of the department, and that the delay was the result of the actions of those officials. And, fourth, if the circumstances do not make it clear that this delay on the part of the officials was wholly justified they do show that it was not wholly unwarranted, and that there were reasons for the action of such officials, which at least deserve consideration and cannot be condemned as trivial.

The three remaining grounds of relief asserted by the Government may be considered together. Defendants contend that as the last two, although urged in the Circuit Court, were not presented to the Court of Appeals, (referring for this fact to the opinion of the latter court and also a notice which was contained in the brief of counsel for the Government,) we are precluded from noticing them, citing as authority *Bell* v. *Bruen*, (1 How. 169;) *Alviso* v. *United States*, (8 Wall. 337;) *National Bank* v. *Commonwealth*, (9 Wall. 353;) *Rogers* v. *Ritter*, (12 Wall 317;) *Klein* v. *Russell*, (19 Wall. 433;) *Supervisors* v. *Lackawanna Co.*, (93 U. S. 619;) *Wilson* v. *McNamee*, (102 U. S. 572;) *Wood* v. *Weimar*, 104 U. S. 786;) *Topliff* v. *Topliff*, (145 U. S. 156;) *McGahan* v. *Bank of Rondout*, (156 U. S. 218;) and *Carr* v. *Fife*, (156 U. S. 494.) in which cases with more or less particularity, the proposition is announced that this court will not consider questions not presented to and passed upon by the lower court. We deem it unnecessary to determine how far that rule is applicable in this case, for the reasons which compel us to deny relief on the first of

these grounds are, when applied to the facts developed by the testimony, equally potent as to the others. That ground, as stated, is "that a patent issued November 2, 1880, upon a division of the original application covers the same invention as that covered by the patent in suit and exhausted the power of the Commissioner as to that invention." The patent of 1880 is for a receiver; that of 1891 for a transmitter. It is claimed that the two instruments are alike in form and alike in function, save as they are operated at different ends of the telephone wire. The transmitter can be placed at the other end of the wire and then becomes a receiver, and so vice versa. Popularily speaking, it may be said that the transmitter takes the varying sounds of the human voice and passes them on to the telephone wire, to be borne along thereon by the undulatory electric current until they reach the receiver, which takes and passes them to the human ear. In a sense the receiver is also a transmitter, for it passes the sounds from the wire to the ear. We agree with the Court of Appeals that it is unnecessary to determine whether there are two separate inventions in the transmitter and the receiver, or whether the patent of 1891 is for an invention which was covered by the patent of 1880. The judgment of the Patent Office, the tribunal established by Congress to determine such questions, was adverse to the contention of the Government, and such judgment cannot be reviewed in this suit.

Suits may be maintained by the Government in its own courts to set aside one of its patents, not only when it has a proprietary and pecuniary interest in the result, but also when it is necessary in order to enable it to discharge its obligations to the public, and sometimes when the purpose and effect are simply to enforce the rights of an individual. In the former cases it has all the privileges and rights of a sovereign. The statutes of limitation do not run against it. The laches of its own officials does not debar its right. (*Van Brocklin* v. *Tennessee*, 117 U. S. 151; *United States* v. *Nashville Railway Company*, 118 U. S. 120; *United States* v. *Insley*, 130 U. S. 263.) But when it has no proprietary or pecuniary result in the setting aside of the patent, is not seeking to discharge its obligations to the public; when it has brought the suit simply to help an individual; making itself, as it were, the instrument by which the right of that individual against the patentee can be established, then it becomes subject to the rules governing like suits between private litigants. As said in *United States* v. *Beebe*, (127 U. S. 338, 347:)

"We are of the opinion that when the Government is a mere formal complainant in a suit, not for the purpose of asserting any public right or protecting any public interest, title or property, but merely to form a conduit through which one private person can conduct litigation against another private person, a court of equity will not be restrained from administering the equities existing between the real parties by any exemption of the Government designed for the protection of the rights of the United States alone. The mere use of its name in a suit for the benefit of a private suitor cannot extend its immunity as a sovereign government to said private suitor, whereby he can avoid and escape the scrutiny of a court of equity into the matters pleaded against him by the other party; nor stop the court from examining into and deciding the case according to the principle governing courts of equity in like cases between private litigants." See also *United States* v. *Des Moines Co.*, (142 U. S. 510;) *Curtner* v. *United States*, (149 U. S. 662.)

Now, in the case at bar the United States has no proprietary or pecuniary interest. The result, if favorable to it, would put no money in its treasury or property in its possession. It has a standing in court either in the discharge of its obligation to protect the public against a monopoly it has wrongfully created, or simply because it owes a duty to other patentees to secure to them the full enjoyment of the rights which it has conferred by its patents to them. Perhaps both of these objects were in view. In so far as the latter was and is the purpose of this suit it brings it within the rule laid down in *United States* v. *Beebe*, *supra*. Doubtless the removal from the public of the burden of a monopoly charged to have been wrongfully created was also one of the objects, and perhaps, the principal object. (*United States* v. *American Bell Telephone Co.*, 159 U. S. 548.) To what extent this may relieve the Government, as suitor, from all the rules governing the suits of private individuals need not be specifically determined here.

One of the familiar rules of equity, reinforced by statute (sec. 723, Rev. Stat.) is that "suits in equity shall not be sustained in either of the courts of the United States in any case where a plain, adequate, and complete remedy may be had at law." The objection to the validity of this patent on the ground that it was already covered by the patent of 1880 is a defense, which, under the statutes, (sec. 4920, Rev. Stat.) is open to every individual charged by the patentee with infringement, whether the proceeding against him be an action at law or a suit in equity. The Government, therefore, if seeking simply to protect the right of an individual, ought not to be permitted to maintain a suit in equity to cancel that against which the individual has a perfect legal defense available in any action brought by or against him. The query is pressed whether the same rule would not also apply when the Government is only seeking to protect the public at large, for the public is but the aggregation of all the individuals, and if each of them has a perfect defense to the patent, so all together have. Again, and as an illustration perhaps of the extent of the rule referred to, it has often been held that while one having the title to and possession of a tract of land can maintain a suit in equity to cancel a deed or other instrument which is a cloud upon the title, such suit cannot be sustained if the deed or instrument is void upon its face, its invalidity resting upon matters of record, and not affected by any lapse of time or statute of limitations. In other words, the deed or instrument is not considered a cloud if it can never be used to destroy his title or disturb his possession. The objection to the patent on the ground stated is an objection resting upon matters of record—of record in the Patent Office; not dependent on oral testimony nor subject to change, and in no way affected by lapse of time. Within the scope of this specific application of the general rule it would seem that equity has no jurisdiction either at the suit of the Government or of an individual to formally cancel that which by record and unfailing evidence is, as claimed, absolutely void.

But, further, Congress has established the Patent Office, and thereby created a tribunal to pass upon all questions of novelty and utility. It has given to that office exclusive jurisdiction in the first instance, and has specifically provided under what circumstances its decisions may be reviewed, either collaterally or by appeal. As said in *Butterworth* v. *Hoe*, (112 U. S. 50, 67:) "That it was intended that the Commissioner of Patents, in issuing or withholding patents, in reissues, interferences and extensions, should exercise quasi-judicial functions, is apparent from the nature of the examinations and decisions he is required to make, and the modes provided by law, according to which, exclusively, they may be reviewed."

Sections 4911 to 4914, Rev. Stat., grant appeals in certain cases to the Supreme Court of the District of Columbia. It is true those sections do not authorize appeals on behalf of the Government, but the failure so to do may be evidence that Congress thought the Government ought not to interfere; and because it believed it had made ample provision for securing the rights of all without the intervention of the Government. Section 4915, Rev. Stat., authorizes a suit in equity on behalf of an applicant for a patent whose application has been refused. *Morgan* v. *Daniels*, (153 U. S. 120,) presented a controversy under that section, and in the opinion, on page 124, we said: "It is a controversy between two individuals over a question of fact which has once been settled by a special tribunal, entrusted with full power in the premises. As such it might be well argued, were it not for the terms of this statute, that the decision of the Patent Office was a finality upon every matter of fact."

It is true that all these sections refer to proceedings between individuals, but the Government is as much bound by the laws of Congress as an individual, and when Congress has created a tribunal to which it has given exclusive determination in the first instance of certain questions of fact and has specifically provided under what circumstances that determination may be reviewed by the courts, the argument is a forcible one that such determination should be held conclusive upon the Government, subject to the same limitations as apply in suits between individuals.

There is nothing in *United States* v. *Bell Telephone Company* (128 U. S. 315,) and *United States* v. *American Bell Telephone Company*, (159 U. S 548,) to conflict with the views above expressed. In the former case the question presented was whether the Government could maintain a bill to set aside a patent for an invention on the ground of fraud in its issue, and among the objections urged was the fact that Congress had, in section 4920, Revised Statutes, made specific provision for certain defenses in suits by an infringer. It was held that the Government could maintain such a bill, and that these special statutory provisions did not defeat its right, the court summing up the discussion in these words, (p. 373:)

"The argument need not be further extended. There is nothing in these provisions expressing an intention of limiting the power of the Government of the United States to get rid of a patent obtained from it by fraud and deceit. And although the legislature may have given to private individuals a more limited form of relief, by way of defense to an action by the patentee, we think the argument that this was intended to supersede the affirmative relief to which the United States is entitled, to obtain a cancellation or vacation of an instrument obtained from it by fraud, an instrument which affects the whole public whose protection from such a fraud is eminently the duty of the United States, is not sound."

In the latter case, which is the one now before us, there was decided a motion to dismiss for want of jurisdiction in this court of an appeal from the decision of the Court of Appeals, and it was adjudged that this court had jurisdiction. It is true, at the close of the opinion is found this general statement as to the power to maintain such a suit (p. 555):

"In *United States* v. *Telephone Company*, (*supra*,) it was decided that where a patent for a grant of any kind issued by the United States has been obtained by fraud, by mistake, or by accident, a suit by the United States against the patentee is the proper remedy for relief, and that in this country, where there is no kingly prerogatve, but where patents for land and inventions are issued by the authority of the Government, and by officers appointed for that purpose, who may have been imposed upon by fraud or deceit, or may have erred as to their power, or made mistakes in the instrument itself, the appropriate remedy is by proceedings by the United States against the patentee."

But while there was thus rightfully affirmed the power of the Government to proceed by suit in equity against one who had wrongfully obtained a patent for land or for an invention, there was no attempt to define the character of the fraud, or deceit, or mistake, or the extent of the error as to power which must be established before a decree could be entered canceling the patent. It was not affirmed that proof of any fraud, or deceit, or the existence of any error on the part of the officers as to the extent of their power, or that any mistake in the instrument was sufficient to justify a decree of cancellation. Least of all was it intended to be affirmed that the courts of the United States, sitting as courts of equity, could entertain jurisdiction of a suit by the United States to set aside a patent for an invention on the mere ground of error of judgment on the part of the patent officials. That would be an attempt on the part of the courts in collateral attack to exercise an appellate jurisdiction over the decisions of the Patent Office, although no appellate jurisdiction has been by the statutes conferred. We are of the opinion, therefore, that the question, as stated, is not open for consideration in this case. We see no error in the decision of the Court of Appeals, and its decree, dismissing the bill, is affirmed.

Mr. Justice Harlan dissented.

Mr. Justice Gray and Mr. Justice Brown were not present at the argument, and took no part in the decision.

DIGEST OF CURRENT TECHNICAL ELECTRICAL ARTICLES COMPILED FROM FOREIGN AND AMERICAN JOURNALS

BY CARL HERING

DYNAMOS, MOTORS AND TRANSFORMERS.

Starting Resistances for Motors. POCHIN. Lond. *Elec.*, May 7.—An article in which, after showing that a liquid resistance controls the current better, he describes wire resistances which approach this action more closely than the usual one. He assumes that the motor has such a load that it will only start with the full working current, and then discusses the best possible arrangement of the resistances; a number of equal steps is a very bad arrangement; he sacrifices three steps to raise the current up to the full current and uses the remaining seven for starting the motor; assuming the resistance of the armature brushes and loads to be 0.1 ohm and the starting current to be 100 amperes he gives the curve of the resistances and the resulting fluctuations in the current; each resistance when cut out corresponds to a rise of 39 amperes, thus the current in no case exceeds 139 amperes, provided sufficient time is allowed for the speed to increase; these resistances all lie in a logarithmic curve; they may be calculated in a few minutes with the assistance of a slide rule; between the one ohm at the fourth contact and the 0.1 ohm at the last six geometric means are to be inserted, and this may be done by dividing the distance between these two readings on the slide rule into the requisite number of equal spaces and reading the corresponding figures. The switch should furthermore be provided with a screw motion, so that it cannot be turned too suddenly; the same theory applies to series motors, for which the steps may be made larger. He describes a switch in which the arc is broken at each contact by means of an additional pin and snap lever, both of which are readily replaced, or a separate switch may be provided with easily renewable faces, for taking up the sparking and worked by a separate handle or by a cam. The ideal switch should prevent sudden switching on, admit of slow switching off or instant switching off; it must automatically switch off in case the supply fails; thus a switch such as described should have a magnetic cut-out and a trigger or pawl, which prevents it from being closed except when the screw switch is in the off position.

Non-Synchronous Motors. POTIER. *L'Ind. Elec.*, April 25, and *L'Eclairage Elec.*, April 17.—An Academy paper supplementary to the one by him which was noticed in the *Digest*, May 1; in the first one he discussed the influence of the distribution of the inductor or magnet windings on the operation of the polyphase motor; he now discusses the effect of the distribution of the circuits of the armature or part in which induction takes place; he limits himself to the theory of the single bi-polar winding. It is mathematical in character, but the results are analogous to those in the preceding paper; there will be two speeds, the smaller being about half the higher, instead of one third.

Armature Reaction and the Theory of Commutation. HAWKINS. Lond. *Elec.*, May 7.—A continuation of his serial (see *Digest* last week). He discusses the reaction under various conditions, using the same style of diagrams, which show the distribution of the line of force; he shows how the conductors on an armature carrying a steady current react on the field, and how they may and do cut their own lines, but never in the sense of thereby producing any increase in voltage; under no circumstances, therefore, can the actively inductive portion of the winding also magnetize the field and so increase the number of lines cut.

Triphase Machinery for a Laboratory. HANAPPE. *L'Eclairage Elec.*, April 24 and May 1.—A continuation of the illustrated description of the apparatus in the laboratory of a school in Mons, the rotary transformer for which was noticed in the *Digest*, Nov. 7; the article is well illustrated and gives a good description of the machines and systems, which are so arranged that they may be conveniently used for instruction; the three-phase circuits, for instance, are so arranged with switches that they may be connected as a triangle or as a star system. Well-illustrated descriptions of the switchboards are given.

Slow Speed Tri-Phase Motor. GEORGES. *L'Eclairage Elec.*, April 24.—An abstract, with illustrations, of the article noticed in the *Digest*, September 12 (see also December 19).

The Reaction Due to Foucault Currents. WESTPHAL. *L'Eclairage Elec.*, May 1.—A full abstract of the article which was noticed in the *Digest*, April 3 (see also May 8).

Reaction of the Armature in Unipolar Alternators. VON KANDO. *L'Eclairage Elec.*, April 24.—An abstract, with illustration, of the article noticed in the *Digest*, January 2.

Iron Losses in Toothed Armatures. BRESLAUER. *L'Eclairage Elec.*, April 17.—An abstract, with the illustrations and some of the formulas of the articles noticed in the *Digest*, March 6.

Brake for Testing Small Motors. MARECHAL. *L'Eclairage Elec.*, April 24.—An illustrated description of a form of prony brake adapted for small motors on which the usual form can be used only with difficulty. A belt or strap passes around the motor pulley and horizontally to another pulley of equal diameter, to which it is securely fastened at one point; to this second pulley is attached an arm, the lower end of which carries weights; the friction of the belt on the first pulley therefore deflects the arm carrying the weights; the power in watts will then be equal to 1.0273 multiplied by the number of revolutions of the motor per minute, the weight at the end of the lever in kilograms, the length of the lever arm in metres and by the sine of the angle of deflection; the motor pulley must be kept well greased through holes in the belt; the tension on the belts, and therefore the load on the motor, may be regulated by weights "symmetrically" placed on the belts, thereby changing their tension.

Dynamo Characteristics. STINE. *Amer. Elec.*, May.—The effect of armature reaction on the characteristics of the dynamo, and the causes for the departure of the actual curves from their theoretical outlines, are discussed; examples are calculated to illustrate the several points; a curve from one of these examples shows that the critical point of the characteristic may be reached on a current output less than one-third the normal capacity of the dynamo, indicating both a weak field and an excessive armature reaction.

Alternators in Parallel. RAYMOND. *Amer. Elec.*, May.—If the alternators have approximately the same armature reaction and regulation, or if they carry the same loads with the same corresponding voltage, the best way to run them is to find the amount of field excitation necessary at different loads to give the required voltage; this being determined for each machine, cross-currents can be avoided with either steady or variable loads by properly adjusting the excitation; in order to even the loads, the governor of the driving source of the most highly loaded machine should be so adjusted that the tendency will be to slightly increase the speed.

Polarity Test of a Dynamo. THOMAS. *Amer. Elec.*, May.—A case is cited where a generator always reversed its polarity when its field circuit was open; the explanation offered is that the compass was held so near the armature head that under field excitation it indicated, not the polarity of the pole pieces itself, but that of the pole induced in the armature core by the field's lines of force; upon removing the exciting current, the armature core, being of soft iron, retained very little residual magnetism, but the cast-iron field core and pole piece retained enough to direct the magnet of the compass. It is recommended that when testing the polarity of an excited dynamo the compass should be held well over on the pole-piece side of the air gap.

Commutator Troubles. MCCLELLAN. *Amer. Elec.*, May.—The use of wooden yokes is condemned; the reason the current jumps is that upon sudden increase of current the arcing due to a loose brush leaving the commutator vaporizes the carbon and copper, and this hot vapor offers to the current an earth path of less resistance than the natural path, which includes the motor's self-inductance, the earth path usually being through a motor frame.

LIGHTS AND LIGHTING.

Luminous Efficiency of the Electric Arc. HERTHA AYRTON. *L'Eclairage Elec.*, May 1.—A communication concerning the article by Blondel (see *Digest*, March 13 and April 10) and those published by her several years ago; one of the points raised concerns the question of priority. Blondel has shown that with a given current a certain difference of potential between the carbons gives a maximum luminous efficiency, this efficiency being the ratio between the light and the power absorbed, while she has shown in what way the ratio of the power absorbed to the power developed by the generator may be made a maximum; in the case of the electric furnace, where the heat efficiency is the only one concerned, the conditions which she gave will suffice.

POWER.

Ventilating Fans. WALKER. Lond. *Elec.*, May 7.—A brief abstract of an Institution of Mechanical Engineers paper, in which he describes some experiments on electrically driven fans. To find the best position of the

central motor, trials were made by placing it in front and in back of the fans and at different distances; the best position giving the highest efficiency depended on whether the fan was working with a contracted or free orifice and on the amount of contraction; the best position was generally found to be at a little distance in front of the fan, where there appears to be a central region where only a small stream of air is delivered; in fans feeding from the tips a wide form of blade may be employed; the general efficiency is increased by arranging them to feed from the tips in addition to the feed through the spaces in the fan disc; it is therefore important that the fan should be fixed with its circumference exposed, which is not always done in practice.

Electrically Driven High Speed Pumps.—Lond. *Engineering*, May 7.—A brief illustrated description of a system in which there are three pump barrels arranged around the motor shaft, the pistons having a very large diameter and very short stroke, enabling them to be run at such high speeds as 700 revolutions; to facilitate starting the motor a by-pass valve is inserted between the suction and the delivery pipes.

Electric Power in Ship Building. Kodolitsch. Lond. *Engineering*, April 30.—A reprint of a recent paper pointing out the advantages offered by electrical transmission, enabling the tool to be brought to the work instead of the work to the tool, and describing briefly (without illustrations) a number of portable electrically driven machines in shipbuilding.

Water Power.—Lond. *Elec. Rev.*, May 7.—A short editorial concerning the proposed utilization of the Nile cataract in which the difficulty lies in the varying level of the water due to the freshets; this is similar to the falls at Rhinefelden, which installation is briefly described.

Electric Pumping. Maltby. *Amer. Elec.*, May.—He describes a number of electric pumping plants designed by himself, and gives the considerations that determine when electric power may be used for pumping services and the best system to be adopted for different conditions. He treats the subject under three heads, based on the nature of the generating power; under one head the electric current is generated by water power at a distance from where the pumps are located; under another the current is generated by steam power at a distance from where the pumps are located, and under the third the current is generated from steam at or near where pumps are located. Under the first head come the instances where water power is owned by private corporations who have power to spare, thus enabling a contract to furnish electric power for pumping for factories or cities to be made with mutual advantage. Many large plants under this head have been installed in the large mining plants of the West, and a description is given of one which supplies a Western city of 10,000 inhabitants with water. Under the second head are pumping plants for small towns, to which current is supplied from electric lighting plants, the pumping in most cases being done at a time when the lighting load on the engine is small; under this head the plants at DeKalb, Ill., and Canandaigua, N. Y., are described, and also a plant at Itasca, Minn., for furnishing fire protection to railroad warehouses. Under the third head are described some steam electric pumping plants for hydraulic elevator service.

Electric Elevator. Sprague. *Elec. Eng.*, May 12.—A reprint of a report of some tests made of the elevator at the city hall, Minneapolis.

Use of Niagara Falls Power.—Elec. Rev., May 12.—A short article stating briefly for what purposes the power is now being used.

TRACTION.

New Accumulator Lines in Paris. Soulier. *L'Ind. Elec.*, April 25.—A long, well-illustrated description of the lines recently started in Paris running from the centre of the city to three of the suburbs; it differs from the usual systems in that the accumulators are charged on the cars at the conclusion of every return trip, for 10 or 12 minutes, with a current of 120 amperes; it has been in operation for only two months; no data concerning cost of operation are given; one of the lines is 6.7 km long, the other 6.6 and the third 4.7; the charging stations are at the suburban ends, all three of which are connected with the power house; the terminals of the underground feeders come up through ornamental posts with which the cars are connected by flexible cables, the terminals of which are such that a wrong connection is not possible, thus enabling the motorman to charge them; the indicator showing when the charge is completed consists of two solenoids, one connected as a shunt to the accumulators, and the other carrying the main current, but in the opposite direction, so that the two neutralize each other; when the voltage is high and the current low the solenoid is magnetized and attracts the armature, which operates a bell. There are 35 cars in use, weighing with 52 passengers, 42 tons; each contains 200 accumulators weighing about 40 pounds each making a total of 8,000 pounds; each has three negative and two positive plates; there are two motors of 25 hp each. Well-illustrated descriptions are given, including a diagram of the controller, the connections and the car wiring; the batteries are charged : discharged in series without any other grouping, the controller mak- : similar connections to those on trolley lines; during the charge ventilating motors are used with the accumulator boxes to carry off the vapors.

Accumulator Traction.—L'Ind. Elec., April 25.—An abstract of the article from the *Elek. Anz.* noticed in the *Digest*, April 17 (see also May 1). It includes the results of the tests.

Propulsion on Canals. Robinson. Lond. *Engineering*, April 30.—The beginning of a reprint in full of his recent lecture, which is noticed in the *Digest* last week; the present portion is entirely non-electrical, discussing canal traction and giving numerous figures and diagrams; among other things, he shows that within the limits of experiments the traction resistance is entirely independent of the length of the boat; the discussion of the paper is published in another portion of that journal, but contains practically no reference to electric traction. In the issue of May 7 the reprint is continued and the discussion concluded, but it contains nothing referring to electric traction. A long abstract containing the references to electric haulage is published in the Lond. *Elec.*, May 7; an abstract of this was noticed in the *Digest*, last week. It appears that it was the chain haulage, which has been used on the Bourgogne canal and has given complete satisfaction; the installation is briefly described; the voltage is 650 and the current varies between 12 and 25 amperes, the motor absorbing a maximum of 18.5 hp; it seems that there are two trolley poles, but whether there are two wires or whether the ground return is used is not clear, but presumably the circuit is metallic; the motor drives a chain drum; the cost of such a system is estimated to be about $6,400 per mile, and the saving in cost over the old steam tugs is over 30 per cent., the cost by the old method being 1.98 cents per ton for 3.75 miles, and 1.36 by electric haulage; the speed was also slightly greater. At the present time experiments are being made on this canal with a small electric traction engine running on the towpath without rails; he concludes that the only plan suitable for English canals is propulsion by means of screws driven either by steam, electricity or oil.

The Lond. *Elec.* May 7 also contains a communication by Galliot, stating that the company which has been experimenting on this canal has been authorized to use this system on the Aire and Deule canal, a distance of 30 km; steam will be used as a source of power; the electrical equipment is ready; it appears that traction engines and screw propellers will be used; it will be working within two or three months; the traffic at the middle of this canal averages over 16,000 boats per year, and this is therefore the most important installation which has been erected.

Test of a Conduit System.—Elek. Anz., April 11.—A short account of some tests made with the Lachmann system in Germany. (This system was described in these columns a year or two ago, the characteristic feature being that the wire is contained in inverted air chambers such that water cannot rise up to the level of the wire.) It was on a short experimental line, some portions of which were flooded; 500 volts were used; one of the chambers was completely filled with water by displacing the air, but the gases formed collected rapidly and very soon lowered the level of the water below that of the wire; the car was run through the flooded portion without any trouble; it was stopped for some time in the flooded portion and then started again without any difficulty.

Heilmann Locomotive. Jacquin. *L'Eclairage Elec.*, April 17.—A long article giving some of the results with the first one constructed several years ago and discussing theoretically the alleged advantages of this construction; it is claimed that the efficiency of transmission is at least equal, if not superior, to that in a steam locomotive, and that this is not unreasonable to suppose; the arrangement gives an absolute constant torque during a complete revolution of the wheels, whatever be the speed; tests of the new locomotive have not yet been made, but are promised as soon as the machine has been tested (it seems that it is not yet completed).

Three-Wire System for Railways. Grove. Lond. *Elec.*, May 7.—A continuation of the discussion of the three-wire *vs.* the alternating-current system for railways (see *Digest* last week, article by Baylor). He replies to Parshall and disagrees with him; he contends that for the Central London Railway the three-wire system is decidedly the better; the loss in the rails which Parshall considered so important would be less, as it is due only to the difference between the currents of the two sides; the factor which decides the question is the distance of the transmission, and where this is not great he thinks the advantages are on the side of the three-wire system.

Trolley Wire on a Drawbridge.—L'Eclairage Elec., April 10.—An illustration of the system used by the General Electric Company, of Berlin; the trolley wire is cut in the middle of the bridge, where each end is fastened to the end of a rectangular frame pivoted at the abutment, and which can be drawn back as the bridge is opened.

Electrolysis from Electric Railway Service. Rowland. *Amer. Elec.*, May.—A summary of the latest conclusions concerning electrolysis from electric railway ground currents, with a discussion of the different methods of prevention of damage to piping. Dependence should not be placed upon voltmeter readings alone in determining the distribution of ground current, as the potential recorded may sometimes be entirely an electrostatic one, and the variable ground resistance also enters. If the positive pole of the generator is connected to the trolley so that the danger district is brought near the station, and large conductors are carried from the pipes at a point near the station to the busbars, the best possible way is furnished to deal with troubles in lead pipes, telephone or other lead-covered cables; it is not a good way, however, to deal with trouble in gas and water mains if these are of cast iron with lead-calked joints, though it may do if the pipe lines in trouble are made with screwed joints and bolted flange couplings; bonding lead-covered cables to the negative bus from a

point near the station, while it saves such cables from the trouble, throws more danger from electrolysis upon other pipe lines. In suburban roads, with no line of piping following the road any great distance, it is best to put the negative terminal of the generator to line. It is stated that on a well-constructed road, where low resistance of the return circuit from the rails is found, there will be little trouble from electrolysis; for a low resistance of rail the main question to be treated is the bonding of the rails, and the resistance of the bond is far more important than that of contact with the rail. The rails should be cross-connected at frequent intervals, and near the station ground return cables should be put in to supplement the track conductor if large currents are to be carried; for high ground resistance keep the track away as much as possible from pipe lines, and in the station make sure there are no ground plates or ground connections on pipes making a low resistance between them and the grounded bus bar. Attention is called to the fact that every pitting of pipes does not mean electrolysis from the railway currents; it may be due to impurities in the pipes or lead cable covers, which set up local electrolytic action; in Baltimore there was trouble of this kind before any electric railways were in operation there.

The Earth as a Conductor. SMITH. *Amer. Elec.*, May.—In tests made in San Francisco on electric railway ground currents, it was established that for every few hundred feet a point could be found from which the current flowed from the pipe system in all directions; it was generally found that in the region surrounding the power house several points could be located toward which the current flowed from all directions; in addition to such points of abnormally low resistance, there are many others in which the resistance is much higher and yet is so much below the average that the greater part of the leakage current will return by local paths rather than be uniformly returned throughout a large region; the result of this is that slow corrosion is going on in spaces distributed throughout the entire region where pipes are positive to tracks; the points of lowest resistance are not really the most dangerous because they can be readily discovered but points of medium resistance are difficult to discover and yet cause local corrosion; the only remedy is to provide metallic paths of so much lower resistance that the current will be practically all shunted off from the earth's circuits. The conclusion of the writer is that an inconsiderable quantity of wire judiciously distributed will afford perfect protection from the dangers caused by variable earth resistance.

Chicago Street Railway Franchises.—West. Elec., May 15.—An extract from the report of Schilling, of the Bureau of Labor Statistics, of Illinois, dealing chiefly with the three leading Chicago systems.

Repair of Electric Railway Apparatus.—Amer. Elec., May.—Different methods are described and illustrated for the prevention of flashing arcs at the commutator of street railway generators; several forms of insulating collars and other devices are described whose object is to increase the path of the arc and thereby prevent its formation. The subject of weak motor fields is also treated.

Efficiency of the Heilmann Locomotive. LEONARD. *Elec. Rev.*, May 12.—An unfavorable criticism of a recent editorial; he argues in favor of the Heilmann locomotive and believes its efficiency will be better than that of the B. & O. locomotives; the cost of the B. & O. plant he believes would be five times as much as equivalent Heilmann locomotives.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Consumption of Electrical Energy in Europe.—L'Eclairage Elec., April 10.—A short note; in Europe, London is at the head of the list; it has 13 lighting stations, and at the end of 1896 there were 1,178,000 lamps (presumably of eight candle-power); the consumption of energy was more than 15,000,000 "kilowatts" (!); next comes Berlin with a consumption of 9,770,000; a single station in that city has 166,000 lamps and 8,000 arcs connected to it; Paris comes next with 7 stations and 545,914 lamps, of which 7,448 are arcs, and 220 electric elevators requiring 2,000 hp; the total consumption in 1895 was 8,107,008; the price in London is 11 cents, in Berlin 10 and in Paris 23 cents per kw hour.

Steam Replacing Gas at Coatbridge.—Lond. *Elec.*, May 7.—An illustrated description of the new Coatbridge station, which was first run with gas engines for about fifteen months, but the gas engines were condemned and have since been replaced by a steam plant; it is stated that the failure of the gas engine in every case where it has been abandoned in electric-light stations was due to remediable defects and not to any inherent faults; similar changes were made at Morecambe and Belfast. The system was arranged for running alternators in parallel, but this does not seem to have been satistactory; fuel gas was used.

Rome. Lond. *Elec. Rev.*, May 7.—A brief description with a number of illustrations of the light and power station in Rome, Italy, where Mengarini's system of using alternating currents for charging accumulators for traction has been used so successfully.

Broomhill Electrical Installation. SALOMONS. *Amer. Elec.*, May.—A description of the private residence lighting plant of Sir David Salomons, at Broomhill, Tunbridge Wells, England. He sketches the development of the plant and describes in detail a number of its special features, among which are a special arrangement for putting the clutch on and off, an electrical method of starting up the gas engine, an installation tester, a testing board, method of bolting together storage battery cells and a number of others. This installation is stated to be the first private residence plant in the world, and represents an outlay, including experiments in electric lighting carried on by the owner, projection lanterns, laboratory apparatus, etc., of $500,000.

Alternating Current Working. RAYMOND. *Amer. Elec.*, May.—Great stress is laid upon the necessity in operating multiphase power plants of perfect co-operation between the men in charge of the generating and power stations respectively; a signaling system for this purpose is described; it consists of two large single stroke gongs placed in series on a 550-volt electric railway circuit, the bells being used in connection with a telephone service.

Storage Battery in Engineering Practice. APPLETON. *Elec. Eng.*, May 12.—He continues the discussion of isolated plants, pointing out the cases in which a storage battery will and will not prove advantageous and economical.

Freaks of Lightning. LATTA. *Amer. Elec.*, May.—In a station running both an electric railway and furnishing current for incandescent lighting, a lightning flash burned out both generators simultaneously, though both had been disconnected from the line at the beginning of the storm.

High Tension Lightning Arresters. GEORGES. *Elec. Eng.*, May 12.—An abstract, with illustrations, of the article which was noticed in the *Digest*, May 1.

WIRES, WIRING AND CONDUITS.

Calculation of Alternating Current Circuits. ALIAMET. *L'Elec.*, May 1.—The beginning of a mathematical article of a comparatively simple nature. Assuming 100 as the weight of copper for the single-phase system and assuming the same loss of energy in the lines, he gives a table of values of the weight of copper for the two-phase and tri-phase system, the former with two and with one return wire and the latter connected as triangle or as star, all for the same voltage of the generator, for the same maximum voltage and for the same maximum difference of voltage between the wires; he then adds to this a comparison with continuous currents, taking into account also the supplementary loss of voltage due to the impedance of the line, which involves no loss of energy, but diminishes the output of the machines; the calculations are made analytically and graphically and are illustrated by numerical examples; in the next portion he intends to discuss the different alternating current systems, supposing sinusoidal currents and equal loads on the various branches.

Impedance Factor in Alternating Current Wires of Large Cross-Section. PICOU. *L'Ind. Elec.*, April 25.—He refers to a previous article (see *Digest*, April 24) stating that the conclusions therein were too brief and might be misinterpreted; the curves correspond to the ideal case in which there is no other self-induction than that of the line, and when there is no apparent consumption of power at the end of the line; "in practice these two conditions are never fulfilled in such a way that the fall of voltage differs from that given by the graphical table." Self-induction in the receiving apparatus tends to increase this loss of charge, while a resistance tends to diminish it, in such a way that the fall of voltage becomes a function of the receiving apparatus itself; the impedance factor in the form given by Kennelly cannot be used directly in the calculation, even in the simple case in which the inductance of the receiver is zero; the best method seems to be to calculate the values of the inductance of the lines in ohms, for the given frequencies, and to use these figures in the numerical applications; these inductances are given in tables for the usual frequencies; he illustrates the matter with an example.

Uninsulated Pipe for Interior Wiring. ZINGLER. Lond. *Elec. Rev.*, May 7.—The beginning of an article in which he compares uninsulated and insulated tubing, defending the former; he compares it with the insulated under a number of different headings and intends to give hints for efficient installations with it, as taken from the results of actual experience. Comparing the costs, the inside diameter must be taken and it is evident that the uninsulated will be cheaper; a table comparing the prices is given, the uninsulated being merely gas pipe; there is also less actual work in fixing the pipe. It will also be mechanically stronger, as the weight of iron per given length is greater; moisture will enter by either condensation or leakage and therefore the wire should have a greater insulation resistance; the insulation of the tube cannot be relied upon and encourages bad wiring; the insulation of either system is proportional to the quality of the wire drawn in.

Interior Wiring.—Amer. Elec., May.—Alternating current appliances, such as balance and reactive coils, theatre dimmers, regulating sockets and the Shallenberger shunt box, are described and their practical applications pointed out.

Drop in Special Incandescent Wiring Circuits.—Amer. Elec., May.—Calculations are given to show the drop in three special circuits in comparison with that in the usual parallel circuit, the circuits being the anti-parallel circuit, the circuit in which the density of the current is uniform in every part, and the same in anti-parallel connecting; it is shown that only in the latter circuit is the drop the same at every lamp.

ELECTRO-PHYSICS AND MAGNETISM.

Electrical Action of Carbon in Flames. FUGE. Lond. *Elec. Rev.*, May 7.—If two platinum electrodes are inserted in a flame, a current can be observed in the wire connecting them, varying with the position of the elec-

trodes in the flames; the same is true of two unlike metals in the same part of the flame. In the present article the author describes similar experiments, using carbon in its various forms in place of the metal; the E. M. Fs. of a number of different metals with wood charcoal, as well as between different forms of carbon are given; with a metal and carbon the current was always from the carbon to the metal through the flame, that is the carbon acted like the zinc electrode of a battery; the E. M. F. between the metals and wood charcoal was somewhat above and below 1 volt; between retort charcoal and wood charcoal 1 volt; between plumbago and wood charcoal about 1.5 volts, being at times as high as 1.7, the wood charcoal acting as the positive plate or zinc; the E. M. F. varies with the temperature of the flame and the quality of the charcoal and other conditions; the thermo-electric effects are different in character, the E. M. Fs. being small and the currents large; the positive pole should be near the centre of the flame for the maximum E. M. F.; with a small spirit flame the internal resistance was found to be over 30,000 ohms; in no case could a current be observed in hot, dry air or carbon dioxide or both mixed. His experiments show that it is possible to construct a battery giving a small current of a high E. M. F., in which coal or charcoal is used as the positive plate, and that a battery can be made in which carbon is used for both positive and negative plates.

Electric Equilibrium Between Uranium and a Neighboring Insulated Metal. Kelvin. *L'Eclairage Elec.*, April 10.—A translation, in abstract, of an Edinburgh Royal Society paper; his experiments show that if two polished metallic surfaces are connected to the envelope and to the quadrants of an electrometer, and when the air separating them is traversed by uranium rays, the deflection produced has the same sign and nearly the same magnitude as if the two metals were connected by a drop of water.

Law of Discharge of Electrified Uranium in Air. Becquerel. *L'Eclairage Elec.*, May 1.—A reprint of an Academy paper from the *Comptes Rendus*, 124, p. 800.

Rotations in a Constant Electric Field. Quincke. *L'Eclairage Elec.*, April 24.—A long abstract of the article noticed in the *Digest*, March 6 (see also March 20).

Principles of Electro-Dynamics. Wiechert. *L'Eclairage Elec.*, April 10; abstracted from the *Wied. Ann.*, 59, p. 283; a long abstract of a paper of a mathematical nature.

Theory of the Generation of Current.—Zeit. f. Elektrochemie, April 5.—A brief criticism of a recent article of a theoretical nature by Bucherer attacking the Nernst theory; the critic, W. N. (presumably Nernst, the editor), claims that Bucherer is in error.

Electrical Conductivity of the Ether. Trowbridge. *Phil. Mag.*, May.—An article which appears to be the same as the one noticed in the *Digest*, May 8.

Temperature and Ohmic Resistance of Gases during an Oscillatory Discharge. Trowbridge and Richards. *Phil. Mag.*, May.—An article which seems to be the same as the one noticed in the *Digest*, April 11.

Dielectric Constant at Low Temperatures. Abegg. *Zeit. f. Elektrochemie*, April 5; abstracted briefly from the *Wied. Ann.*, 60, p. 54.—He determined it for alcohol and similar compounds.

Effect of Temperature on the Dielectric Constant of Liquids. Hasenoehrl. *Zeit. f. Elektrochemie*, April 5.—A brief abstract showing a close agreement with the Clausius-Mossotti formula.

Apparatus for Studying Electric Waves. Bose. *L'Elec.*, May 1.—A reprint of an Academy note (papers on the same subject by the same author were published in English some time ago).

Liquid Coherers and Mobile Conductors. Appleyard. *Phil. Mag.*, May.—A reprint in full of the article noticed in the *Digest*, April 17.

Electrodynamic Radiations from the Sun. Wilsing and Scheiner. *L'Eclairage Elec.*, May 1; abstracted from the *Wied. Ann.*, 59, p. 782.—They made some experimental investigations with the variation of a contact resistance under the influence of solar radiations, and obtained results indicating the existence of electrodynamic radiations, but the results are not thought to be absolutely reliable.

Variations in Temperature of a Conductor Traversed by an Alternating Current. Guye. *L'Eclairage Elec.*, April 24.—An abstract of an article of a mathematical nature, in which he develops formulas giving the variation with the time, of the temperature of a wire through which an alternating current passes; he applies some of the deductions to the electric alternating current arc and to current measuring instruments. He shows that the variation of the temperature has a sinusoidal form with a frequency double that of the current, and the maximum values are shifted in phase from those of the current; when applying the formulas to thermic instruments he shows that the oscillations of the temperature will be retarded practically an eighth of a period. The lag in the arc is probably less than in the metallic wire; this lag may be part of that which alters the form of the voltage curves in the arc.

Oscillating Discharge of Condensers. Busch. *L'Eclairage Elec.*, April 24; abstracted from the *Wied. Ann.*, 59, p. 595.—He repeated the experiments of Oettingen, eliminating certain causes of error; he measured the first charge and then the residual charge after stopping the discharge at a certain time. He shows that self-induction plays an important part in the production of residual negative charges; he doubts that the residual negative charge characterizes the oscillating discharge.

Energy of an Electrified System and the Capacities between Conductors. Potier. *L'Eclairage Elec.*, May 1.—A short article of a mathematical nature in which he discusses the usual formula, in which certain coefficients are indeterminate and shows how the formula might be modified so that the factors are determinate; he considers it preferable to the form adopted by the followers of Maxwell.

Graphical Determination of the Effective Value of a Periodic Function. Fleishman. *L'Eclairage Elec.*, April 10.—An abstract with the formulas and diagrams of the article which was noticed in the *Digest*, February 20.

Atmospheric Electricity in High Regions. Le Cadet. *L'Elec.*, May 1.—A reprint of an Academy note giving briefly the results of observations in a balloon ascension in which a new instrument for that purpose was used; he found among other things that the electric field is certainly weaker above 1500 meters than in the region of the earth's surface.

Transformation of Diamond into Graphite. Moissan. *L'Eclairage Elec.*, April 10, and *L'Elec.*, May 1; a reprint of his Academy note which was noticed in the *Digest*, May 1.—He examined the black coating which Crookes had found was produced on diamonds subjected to cathode rays and he found it by chemical means to be graphite; it thus follows that the temperature was probably as high as in the electric arc, as diamonds cannot be transformed into graphite at a less temperature than 2000°.

Simple Method for Separating Alternative Discharges in a Vacuum Tube. Hildebrand. *L'Eclairage Elec.*, April 17.—An abstract from the *Wied. Ann.*, 59, p. 273.—He uses the well-known action which a neighboring conductor, insulated or connected with the earth, has on the discharge: a tube may be placed on wooden supports on a table containing tinsel and the current will then be drawn down to one of the supports and repelled from the other; other modifications are described.

Polarization Phenomena in Hittorf Tubes. Nebius. *L'Eclairage Elec.*, May 1; abstracted from the *Wied. Ann.*, 59, p. 695.—He describes some experiments with the passage of a current of relatively low voltage through a rarefied gas which is traversed by another current.

Coloring of Salts with Cathode Rays. Goldstein. *Zeit. f. Elektrochemie*, April 5.—An abstract of his recent paper from the *Wied. Ann.*, 60, p. 491.

Mutual Action of the Electrodes and Cathode Rays. Deslandes. *L'Eclairage Elec.*, April 10.—A long abstract of the French Academy paper which was noticed in the *Digest*, May 1.

Double X-Ray Tubes. Courmelles and Seguy. *L'Eclairage Elec.*, May 1.—An Academy note from the *Comptes Rendus*, 24, p. 814.—Two complete tubes were connected with a spherical receiver, the anodes and cathodes being all in the same axes and the anode rays being directed toward the bottom; with this they noticed some interesting effects, namely, that the pressure in a tube is not equal in all the parts, that is, in one of the bulbs which was connected to the cathode the vacuum was much more complete than at the other extremity of the same gaseous circuit and that the molecules were projected with extreme violence to the most extreme part of the apparatus; this may be shown by connecting the two tubes in series, when cathode and Röntgen rays will be formed only on the side of the first cathode, while at the other part bright violet stratifications were produced without any fluorescence; when the two tubes were connected to two coils both will give X-rays. They conclude that there is an unequal distribution of the material produced by the passage of the current; at a very high rarefaction, the tubes being connected in series, both will generate X-rays, but the one whose cathode is connected to the coil gives much more; when connected in parallel the one with less resistance will give X-rays and the other luminous effects; the use of two tubes enables one to obtain two images of the same object, which is of use in connection with the stereoscope; it also gives one mathematical data, forming triangles, from which one can calculate the exact positions of various bodies whose location is to be determined.

Photographic Actions in and Around Vacuum Tubes. Battelli. *Nuovo Cimento*, March, p. 169; noticed briefly in the Lond. *Elec.*, May 7.—He made experiments with actinic effects inside and outside of vacuum tubes and found that the photographic effect in both places decreases as the radius or length is increased; a disc-shaped cathode is more affected than a point-shaped one; as regards current strength and exhaustion there are some decided differences between the internal and external actions; the current required for internal effects is only one-fifth or one-tenth of that required for the same impression outside, whatever be the pressure; the maximum outside effect is attained long after that on the inside has reached a maximum; the latter commences at a pressure of 0.65 and the former at 0 1 mm.

Action of X-Rays on the Heart. Seguy and Quenisset. *L'Eclairage Elec.*, May 1.—An abstract of an Academy note in which they show that when a person is subjected to the action of X-rays for a very long time peculiar heart troubles are produced, manifested by unendurable palpitations and very violent and irregular beats.

X-Rays. Villari. *L'Eclairage Elec.*, April 10.—An abstract of a paper from the Italian discussing the action of an ozonizer on gases subjected to the action of X-rays or the electric spark and on the gases of combustion.

Stereoscopic Radiography. Marie and Ribaut. *L'Ind. Elec.*, April 25.—

An abstract of an Academy note. They give the theory of precision in stereoscopy and verify its application to radiographs; they have always obtained excellent results.

Influence of Tension and Compression on the Thermo-Electric and Magnetic Properties of Metals. MEYER. *L'Eclairage Elec.*, April 17.—A long abstract from the *Wied. Ann.*, Vol. 59, p. 134.

Tempering Magnets. BARUS. Lond. *Elec.*, May 7; abstracted from *Terrestrial Magnetism*, March.—It is a summary of Barus's researches on the hardness and magnetic stability of steel; he uses the term thermo-electric hardness and defines it as the E. M. F. in micro-volts per degree at zero, of a thermo element consisting of steel in the imaginary normal state, whose resistivity is zero, and steel in any given state. The relation between the thermo E. M. F. per degree at zero and resistivity at zero is linear throughout the range of variation of these qualities with hardness; hardening of steel may increase its resistance threefold. As a result of his researches he gives valuable hints for making highly permanent magnets; having tempered a steel rod glass hard and uniformly, it is exposed for 20 or 30 hours or longer to the annealing effects of steam at 100°, which imparts to it the maximum of permanent hardness for that temperature; it is then magnetized to saturation and again exposed to steam for about five hours; it will then have the maximum permanent magnetization, and the maximum of permanent hardness for that temperature, and its degree of magnetic permanence against effects of temperature below 100°, against time and percussion, is probably the highest conveniently obtainable.

Greenland Magnetic Observations. PUTNAM. Lond. *Elec.*, May 7; abstracted briefly from *Terrestrial Magnetism*, March.—A report of the magnetic observations made on the Peary expedition; a diagram is reproduced.

Vertical Earth Air-Currents. BAUER. Lond. *Elec.*, May 7; abstracted briefly from *Terrestrial Magnetism*, March.—After discussing the work of others in this direction, he makes deductions from Schmidt's computations eliminating some errors, and then finds that there appear to be such currents; between 40° and 50° N, for instance, they amount to an average of 0.091 ampere per sq. kilometer; a general resemblance is traced between them and the electrical currents resulting from the rotation of a magnetized sphere in a conducting liquid.

Glowing of Disconnected Incandescent Lamps. AMSTUTZ. *El'ty*, May 12.—A short article describing some experiments which appear to consist of subjecting a disconnected lamp to the effect of electrostatic fields either by rubbing the lamp, revolving it in an electrostatic field or moving it toward or away from a charged plate, in all of which cases the lamp glowed; the candle power in one of these experiments was roughly estimated to be one-quarter of a candle.

ELECTRO-CHEMISTRY AND BATTERIES.

Electro-chemical Equivalent of Carbon. COEHN. *Zeit. f. Elektrochemie*, April 5.—A short preliminary paper. It was found that the disintegration of positive carbon electrodes is not only due to a mechanical disintegration but also to a chemical action; this latter action does not seem to follow the simple laws which apply to the metals; it seems to depend not only on the current but also on other factors, such as the concentration of the electrolyte; a number of cells similar in all other respects except concentration were connected in series and the coloring of the solution after ten hours was in the same proportion; in concentrated solutions there is destruction without the formation of a colored solution and with the more dilute solutions there is an increasing intensity of the coloring; the temperature also has an effect; in the most concentrated solutions the destruction of the carbon diminishes with an increasing temperature and the coloring of the solution increases. The question arose whether it was possible to have carbon follow Faraday's law, and he made a number of researches to determine the electrochemical equivalent by the loss of carbon; the temperature and concentration were chosen so that there was no mechanical destruction, which was the case when equal volumes of concentrated acid and water were electrolyzed at 100 degrees; the calculated and observed values are given, the theoretical equivalent being 3; the observed value was 3.5; experiments were repeated by filtering the solution and subtracting the weight of solid carbon, of which a little was formed, and the results at different concentrations were very close to 3; the results show that the amount dissolved did not depend on the current density and was independent of the temperature and concentration; more complete results are to be given in a subsequent article.

Carbide of Iron. MOISSAN. *L'Eclairage Elec.*, April 24; from the *Comptes Rendus*, 124, p. 716.—He describes how to prepare carbide of iron by direct union; Swedish or very pure iron was fused in an electric furnace in the presence of sugar carbon and was allowed to cool slowly, but he was not able to obtain the crystallized carbide; the metallic mass contained numerous crystals of graphite, but only one per cent. of the carbide; he therefore concluded that the carbide which formed at high temperature was again decomposed on cooling; he therefore tried cooling it suddenly, and was thus able to obtain a metallic carbide rich in carbide of iron, the percentage of combined carbon being 5.25; to obtain the carbide very pure the fused mass should not be completely saturated, and the formation of graphite should be prevented; 500 grams of Swedish iron were heated in a carbon crucible, which furnished the necessary carbon for three minutes with a current of 900 amperes at 600 volts, the crucible being plunged into cold water immediately afterward; the mass thus obtained is very hard, brittle and remarkably crystalline and contains only a trace of graphite and three to four per cent. of the combined carbon. The properties of the carbide of iron are given briefly.

Decomposition of Sulphur. GROSS. *Elektrochem. Zeit.*, April.—A long article in which he describes a number of experiments, in some of which he obtained new reactions which appear to show that sulphur can be decomposed electrolytically. The possibility of the decomposition of sulphur cannot be denied; melted sulphur conducts the current continuously and with polarization, and its conductivity increases with the temperature; sulphur behaves electrically quite analogously to resins; in one of these experiments the sulphur disappeared entirely and a new substance was produced by its decomposition, to which he gives the name bythium; the tests are to be continued.

Purification of Sugar. BAUDRY. *Elektrochem. Zeit.*, April.—A long report with considerable tabular matter and experimental data on the Scholl-meyer and Huber process, which has been in use at Stepanowka, Russia, for some time and is reported to be very successful; figures are given showing the saving in cost by the use of electrolysis. He concludes that electrolysis precipitates three times as much of the nitrogen compounds as the usual process; electrolysis acts very powerfully on the organic compounds containing nitrogen; it follows that it therefore requires less lime for the final purification, a fact which has been demonstrated by practice; the purification caused by a small amount of lime in combination with electrolysis is much more powerful in its action than that produced by much larger amounts of lime; the combination of electrolysis and lime, as distinguished from electrolysis alone, therefore has actual and important advantages; the liquor can be treated more quickly, it is better, and the process involves a large saving in the cost. A diagram of the installation is included.

Industrial Production and Application of Ozone. OTTO. *L'Ind. Elec.*, April 25, and *L'Elec.*, May 1.—A short abstract of a recent paper read at the Society of Civil Engineers of France, showing that the efficiency of the usual apparatus is only 2 per cent. and that the causes of loss were due to the heating and the very short duration of the action of the discharge on account of the long interval between the successive sparks; he has improved the apparatus in this direction and now obtains an efficiency of 15 per cent.; he also determined the law that the efficiency is proportional, everything else being the same, to the frequency of the current in the apparatus; he also described the action of ozone on certain organic compounds.

Lead. WALTER. *Zeit. f. Elektrochemie*, April 20.—A short article on the process of preparing lead so as to make it easily attacked by chemicals for the production of white lead, accumulator plates, etc.; he refers to a previous article (see *Digest*, April 10) concerning his electrolytic process, and in the present article describes the application of it. It appears that the process (which is not described) consists of making an alloy of lead with an easily oxidized material by means of an electrolytic process and then dissolving out the easily oxidized metal; the process may also be used for alloys of zinc and copper; sodium or potassium gave good results with lead.

Progress of Electro-Chemistry in the United States. ULKE. *Zeit. f. Elektrochemie*, April 5.—The beginning of an article, including a table giving data for eleven copper refining installations, the combined daily product of which is 342 tons of copper, besides 41,016,000 ounces of silver and 68,255 ounces of gold per year.

Production of Metallic Hydroxides and Sulphides.—Elek. Anz., April 11.—A brief description of the Lorenz method as applied to a number of the metals; he found that when a solution of an alkaline salt is so electrolyzed that the anode is made that metal of which the hydroxide is to be formed, the cathode being platinum, the metal dissolved at the positive electrode will be precipitated as hydroxide by the equivalent amount of alkaline hydrate generated at the negative electrode.

Potassium Percarbonate. VON HANSEN. *Zeit. f. Elektrochemie*, April 20.—A description of the production and the properties of this material. By electrolyzing a concentrated solution of potassium carbonate at a low temperature the percarbonate will be produced in the form of a milky precipitate; the temperature, concentration and current density are important factors and must be kept within very narrow limits.

Laboratory Elektrolyzer. WEHRLIN. *Zeit. f. Elektrochemie*, April 20.—An illustrated description of a convenient form of laboratory apparatus; it consists essentially of a very short hollow cylinder of some insulating material, the two ends of which are closed with discs forming the electrodes, the whole forming a closed tank having openings into it for inserting pipes for the circulation of the liquid or the drawing off of the gases and also for the thermometer; the end plates are held on by means of external bolts so that the whole can be dismantled; diaphragms can also be inserted.

New Electrolytic Hypothesis Concerning Chlorine Production. HARGREAVES. *Elektrochem. Zeit.*, April.—A short article in which he advances a new theory to the effect that the migration of ions is in one direction and not in two; that an anion is only a by-product; that the cathode is only a passive obstruction; and that the cathion must not always throughout the whole electrolytic chain be paired with the same anion.

Application of the Carnot Principle to the Theory of the Cell. Raveau. *L'Eclairage Elec.*, April 10 and May 1.—The application of this principle to the voltaic cell and electrolysis leads in a simple way to the establishment of formulas which have been verified experimentally with great precision and which show that such an application is legitimate; the efficiency of a dynamo is necessarily less than unity, and it is therefore argued by others that the voltaic energy in a battery is always less than the diminution of energy corresponding to the chemical transformations, but this he says is not correct and proceeds to show it; the formulas being established it is the comparison of the experimental results which alone can show to what limits the Carnot principle is applicable. In the second portion he discusses at length the writings of Helmholtz, Gibbs and others; he shows how the application of the Carnot principle enables one to establish, in isothermic cycles, the relations which exist between the E. M. F. and the concentration or pressure on the one hand, and to give the expression of the primary and secondary derivatives of this E. M. F. as a function of the temperature.

Capacity of Polarization of Mercury Electrodes. Ohrlich. *Zeit. f. Elektrochemie*, April 5.—A brief abstract of a thesis on an experimental determination; his results agree with those of Wien; the chlorides have the greater capacity; then come the nitrates and then the sulphates.

Experimental Proof of the Clausius-Mossotti Formula. Millikan. *Zeit. f. Elektrochemie*, April 5; abstracted briefly from the *Wied. Ann.*, 60, p. 376. The results confirm the theory very closely.

Effect of Great Current Strength on the Conductivity of Electrolytes. Richards and Trowbridge. *Phil. Mag.*, May.—An article which appears to be the same as the one noticed in the *Digest*, May 8.

Determining the Atomic Weight of Mercury and Cadmium. Hardin. *Chem. News*, 73, p. 61 and 77; abstracted in the *Zeit. f. Elektrochemie*, April 5.—He used the electrolytic method.

Chemical Synthesis by Means of the Dark Electric Discharge. Lasonitsch and Jovitschitsch. *Zeit. f. Elektrochemie*, April 5.—A brief abstract giving the results of their experiments.

Difference of Potential Between Metals and Electrolytes. Wiedeburg. *L'Eclairage Elec.*, May 1; abstracted from the *Wied. Ann.*, 59, p. 742.—An abstract of the article noticed in the *Digest*, March 20, under "Contact Electricity."

Internal Resistance of Accumulators. Haagn. *Zeit. f. Elektrochemie*, April 5.—He gives the results of measurements of the internal resistance of accumulators during charge and discharge, using the method of Nernst and Haagn (which was described in the *Digest*, April 4, 1896, and which is a modification of the well-known Kohlrausch method, in which the source of the current for the Wheatstone bridge is an induction coil and the galvanometer is replaced by a telephone; in the present modification two arms of the bridge consist of condensers, the third being an adjustable resistance and the fourth the battery); the method has shown itself to be well adapted for the measurement of small resistances and may be used for measuring internal resistances of galvanic cells with or without current. The results for several accumulators are given in the form of curves and tables; the resistances for the same phase of the charge and the discharge were approximately the same, and that of an overworked accumulator returns to its true value like the E. M. F.; the resistance at discharge increases at first slowly and then rapidly; during the charge it goes back in a similar way. From this he thinks it may be safely concluded that the increase of resistance during the discharge is caused not only by the decrease in concentration of the acid, but also to a contact resistance on the electrode itself. To determine the latter he measured each electrode in connection with zinc (which requires a current from an external source when the zinc and lead are measured together) and found that the rapidly increasing resistance at the end of the discharge is chiefly due to this contact resistance on the peroxide electrode; it is therefore probable that the processes during the discharge do not both lead equally on the two electrodes, to the formation of the sulphate, but that on the positive electrode there are some complicated processes. The measurement of the internal resistance as an indicator of the amount of charge is no more reliable than the measurement of the E. M. F.; a necessary condition for the present test is a very sharp minimum; for cells with small polarization capacity a special compensation method must be used, by inserting in that bridge arm a second polarization capacity; this will be described in a subsequent article.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Electrometer as a Differential Instrument. Arno. *L'Eclairage Elec.*, April 17.—An abstract from a recent work on electrical measurements, showing how this instrument can be used as a differential apparatus. One pair of opposite quadrants is connected to one end of the circuit and the other pair to the other; the two objects to be compared are connected in series with each other, and between these two points, and are therefore in parallel with the quadrants; the needle is connected to the junction between the two objects. This affords a simple method for measuring the capacity of a condenser, to be used for alternating currents, with a current of the same frequency; the condenser is made one of the two objects and a resistance box is made the other, an alternating current being used as a source and the needle being connected as described; the resistance is then adjusted until there is no deflection and the capacity in farads will then be equal to 1 divided by $2 \pi r n$, in which r is the resistance in ohms and n the frequency of the current; the method is only approximate if the currents are not sinusoidal. It can also be used to measure the coefficients of self-induction of a coil, the coil being inserted in the place of the condenser; the formula is given. Knowing the capacity and self-induction of the coil these methods can also be used as a measure of the frequency.

Determining the Angle of Lag. Rayleigh. *Phil. Mag.*, May.—A short article in which he describes a method based on the use of an oblique soft iron galvanometer needle placed at an angle of 45 degrees between two parallel coils; the needle is suspended by a torsion fibre; two currents, the lag between which is to be determined, are passed through the two coils and from the deflections the angle of lag may be calculated; the deflections are obtained for each of the currents separately and for both of them combined; the cosine of the angle is then equal to the latter less the sum of the other two and divided by twice the square root of these two deflections; thus the phase difference is determined independently of any measurement of the absolute values of the current; the most accurate method will be to restore the needle to zero by means of the torsion head, but with moderate angles the deflections will suffice. He discusses briefly the application of the formulas when the currents deviate from the sine type.

Oscilograph. Abraham. *L'Eclairage Elec.*, April 17.—A description of his new form of instrument, together with a theoretical discussion and illustrations of the curves obtained with it. The galvanometer with a movable coil is used as the most sensitive instrument; the proportionality between the deflection and the deflecting current is usually attained by considering the effect of inertia as negligible; he adopts a different solution than this, and one which is more complete; he gives an equation showing the conditions under which exact proportionality will assist, and shows how this can be satisfied with the aid of induction; the main current acts inductively on an auxiliary circuit, which in turn acts on the shunted circuit in the instrument; the registering is accomplished by means of a beam of light.

Oscilographs. Blondel. *L'Eclairage Elec.*, April 17.—A short article suggesting some new applications; they can be used for studying the rapid variations of the resistance of a conductor; if a current passes through a conductor one oscilograph is used as an amperemeter and another as a voltmeter; for recording the variations of a resistance as a function of the current the two instruments are placed at right angles and the beam of light is reflected from one to the other, the mirrors moving in axes perpendicular to each other; the hysteresis curves can also be traced directly, one instrument having the exciting current passing through it, and the other being connected to a small inductor; several examples of these applications are promised.

Standard Cells. Mauri. Lond. *Elec.*, May 7.—A brief abstract from an Italian journal; it is a second paper on acetate (see *Digest*, last week) and other cells, and contains a large amount of experimental data for various electrodes and solutions. He found that all cells of a constant E. M. F. take some time to settle down to the final value, and this time is increased by diluting the solutions, which he explains by the disassociation theory; if the solution is concentrated the requisite number of ions is soon provided, but if dilute they will have to come from a greater distance; it follows that such cells should contain nothing but concentrated solutions.

Resistance Standards.—Lond. *Elec.*, May 7.—Illustrated descriptions of those made by Elliott Brothers from 1 ohm down to 0.0001; they are all made of manganim coated with varnish, and the error due to the temperature for the maximum current does not exceed 0.025 per cent.; a test made by the Reichsanstalt agreed within 0.005 per cent. with the value obtained by the makers.

Principle of the Construction of Mirror Galvanometers. Des Condres. *Zeit. f. Elektrochemie*, April 5 and 20.—The beginning of a series of articles of a general nature discussing the theories underlying the action and construction of galvanometers, especially those of great sensitiveness.

Apparatus for Measuring Frequencies. Meyer. *L'Eclairage Elec.*, April 17.—An abstract, with an illustration, of the article noticed in the *Digest*, February 20.

Measurement of Resistances and E. M. Fs. Armagnat. *L'Eclairage Elec.*, April 10, 17 and 24.—A continuation of his long serial; he discusses the various methods for different purpose.

Sectorless Wimshurst Machine. Keenan. *Amer. Elec.*, May.—The writer takes issue with a statement condemning sectorless Wimshurst machines; he states that he has just built a 12-plate, 32-inch diameter sectorless machine which works very well, and he considers that the sectorless machine is easier to construct, gives a longer and more intense spark, is more readily cleaned and will work in any weather in which one with sectors will.

Construction of the Galvanometer. Sheldon. *Amer. Elec.*, May.—The construction of the d'Arsonval galvanometer is described, accompanied with the necessary working drawings.

Faults in Measuring Instruments.—Amer. Elec., May.—Faults to which the voltmeter, the ammeter, and recording wattmeters and ammeters are subject are described, and methods for their prevention and cure are pointed out.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Microphonic Telephonic Action. FESSENDEN. *Amer. Elec.*, May.—A reply to a previous article by Berliner, in which the latter quoted experimental facts to sustain his theory of constant contact and variable-pressure microphonic action. Fessenden maintains that the microphonic action is due simply to difference in contact area, while Berliner considers that the change of resistance in pressure is due to the variation in the thickness of the layer of air or gas between the two electrodes in so-called contact; Fessenden considers that the facts observed by Berliner agree quite as well with the contact theory as with the gas theory, and that the law of variation of resistance is inconsistent with any theory yet proposed, except that of the variation of direct contact.

Telegraph and Telephone Speed.—Elec. Eng., May 12.—An editorial comparing the results of tests made abroad and in this country; they show that Morse transmission in Belgium is far less behind the Hughes apparatus in speed than is generally supposed, the speed of the latter being only 50 per cent. greater; the speed of the Morse transmission in a test in this country gave an average of 2,043 words per hour during five hours, which is only 15 per cent. less than that obtained by the Hughes apparatus, while it exceeds the Morse work in Belgian by over 20 per cent.; a comparison of the telephone and telegraph showed a speed of 18 words per minute for the telegraph and 38 for the telephone.

American Telephone Practice. MILLER. *Amer. Elec.*, May.—The hook switch and circuits of the telephone are the subjects of the present installment of this serial. Diagrams showing the telephone circuits of several different systems are included.

MISCELLANEOUS.

Carbide Industry in Germany. FRANK. *Zeit. f. Electrochemie*, April 5.—A short article, chiefly of local interest, calling attention to the possible utilization of the large peat beds in Germany; he states that 30 tons of peat will produce one ton of carbide, which means that the calorific equivalent ot 30 tons can be condensed into one ton, thus reducing the cost of transportation of the equivalent stored energy to 1/30; these peat beds in one district alone cover an area of about 55 square miles (presumably this means German miles).

Electric Gas Ignition.—L'Elec., May 1.—A brief illustrated description of an attachment to a Welsbach burner for lighting and extinguishing it from a distance. It consists essentially of a small solenoid in the base of the burner which acts on a movable iron core, the bottom of which closes the valve; a current in the circuit moves the core upward, which motion appears also to act on a cam which operates the valve; (the illustration is not quite clear); the current passes through a fine spiral of platinum wire which is thereby heated, thus igniting the gas; to extinguish the light the current is sent through a second time and the core in striking, the cam in the position in which it then is closes the valve.

Guttapercha Extraction.—Lond. *Elec.*, May 7.—A brief description of the Serullas process, in which the material is extracted yearly from the leaves and twigs instead of only every 17 years from the sap; the method of extraction is described and an analysis is given, showing that the average is purer than the best ordinary guttapercha.

Mica.—Lond. *Elec. Rev.*, May 7.—A brief article on its uses and giving the results of some breaking-down tests; the highest voltage required when the mica was placed between two metallic plates was below 5,000 volts for a four-mil sample, the agreement between all the tests of the same thickness being quite remarkable.

Biographical. ARNO. *L'Eclairage Elec.*, April 10.—A long biographical notice of the late Galileo Ferraris.

Biographcal.—Elek. Anz., April 15.—A briet biographical sketch, with portrait, of the late Heinrich Von Stephan.

Safe Cracking by Electricity.—Amer. Elec., May.—An article discussing the practical conditions involved in the operations of electric burglary. A No. 1 or No. 2 wire would be sufficient to carry the necessary current, which could not be obtained from an isolated plant without attracting the attention of the dynamo attendant; the tap may be made to a distributing main, if of as large as No. 1 wire, or to the street connection; as access will be necessary in the second case to the street connection, and to the main fuse in the first case, it is recommended that these be guarded. It is considered impractical to introduce a storage battery on the bank premises on account of the size necessary to give from 250 to 300 ampere discharge; with a discharge rate of ten times the normal rate 25 cells would be required, each of which, if bought on the market, would weigh over 150 pounds. Even with a still more abnormal rate of discharge, the plates of a battery required, even for 50 volts and for 350 amperes, could not conceivably weigh less than 500 pounds with receptacles and without the electrolyte. An estimate is given for the cost of a generating plant in a neighboring building, the entire outlay being found not to exceed $3,000 for a new plant; a storage battery of necessary size similarly installed can be purchased for $2,000 or less; the operations would be complicated by taking the current from a trolley wire, as the amount required would correspond to 250 horse-power or an equivalent for a load of not far from 20 cars, which at night would attract immediate attention. A list of the materials necessary for the electric perforation of safes is given, and the conclusion arrived at that these can be easily introduced on the premises by burglars. The conclusions are that electric safe cracking involves no peculiar difficulties if an attachment to a street main is possible, or if current can be obtained from a storage battery or a generating plant in a neighboring building, but that a high order of electrical skill is demanded; if a safe has been electrically perforated it does not seem to follow that its contents, particularly in the case of a large safe, would be at the mercy of the burglar.

Attacking Safes with the Electric Arc. KAMMEYER. *Elec. Rev.*, May 12.—A short article defending the method and quoting a statement by Pumpelly on the subject; the latter described a practical demonstration of the feasibility of obtaining the current from a storage battery; 150 amperes at 40 volts were used to burn a hole through a spherical safe in one minute and eight seconds, the hole being 1.5 inches in diameter, which, it is claimed, "gave ample facility to get at the contents of the safe;" he thinks 5,000 watts would be ample and that the battery would not weigh 300 pounds. Hoffmann, in another quotation, considers the idea quite feasible.

Restoring the Original Color to Hara Rubber.—Amer. Elec., May.—The rubber may be dipped for a second or two in bi-sulphide of carbon or rubbed with a piece of cotton saturated with the liquid, care being taken that the rubber is not softened by using too large a quantity of the liquid; a fair polish may be obtained by using a dry piece of flannel and rubbing vigorously; should the discoloration be more than superficial, it is necessary to work over the entire surface with sandpaper or pumice stone and then repolish with rotten stone and oil.

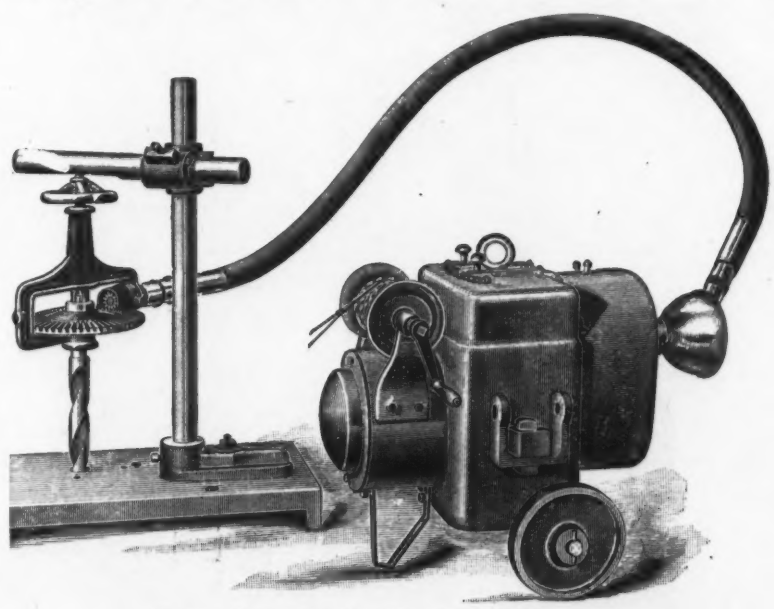
Electrical Catechism—Amer. Elec., May.—The current installment is on two and three-phase distributing circuits, and on windings of two and three-phase generators.

A Portable Drill Outfit.

A portable outfit for drilling, tapping, reaming, etc., finds very extensive application in many of the mechanical industries, and its successful application generally requires the employment of flexible shafting.

The apparatus described and illustrated here is made by the Stow Manufacturing Company, Binghamton, N. Y. By its use the classes of work above specified can be done by electric power at any reasonable distance from the source of power.

The motor is practically dust-proof and water-proof, and is of new design. The frame is in the form of a hollow tube with inwardly projecting



DRILL OPERATED BY FLEXIBLE SHAFT.

poles. In each end of the frame is a circular aperture, over which is bolted the end plates supporting the bearings. One of these is extended into a short cylinder forming a case for the commutator and brush holder. The field coils are protected by metallic cases and can be easily removed. The motors below two horse-power are bipolar and those of two horse power and over have four poles. The best of material is used in their construction. The rheostats are protected by an iron case and the gears are covered. By simply changing the end plates, to bring the oil-chambers below the bearings, this motor can be run in almost any position.

Motors of this type can be furnished for direct connection when desired, also for electric street railway track drilling. The portable motor illustrated is fitted with truck wheels, leg, eye bolt, side brackets, reel, 20 yards of insulated wire, and one set of reduction gears. By the use of a speed regulator and gears almost any practical speed can be obtained.

A New Arc Lamp and a New Alternator.

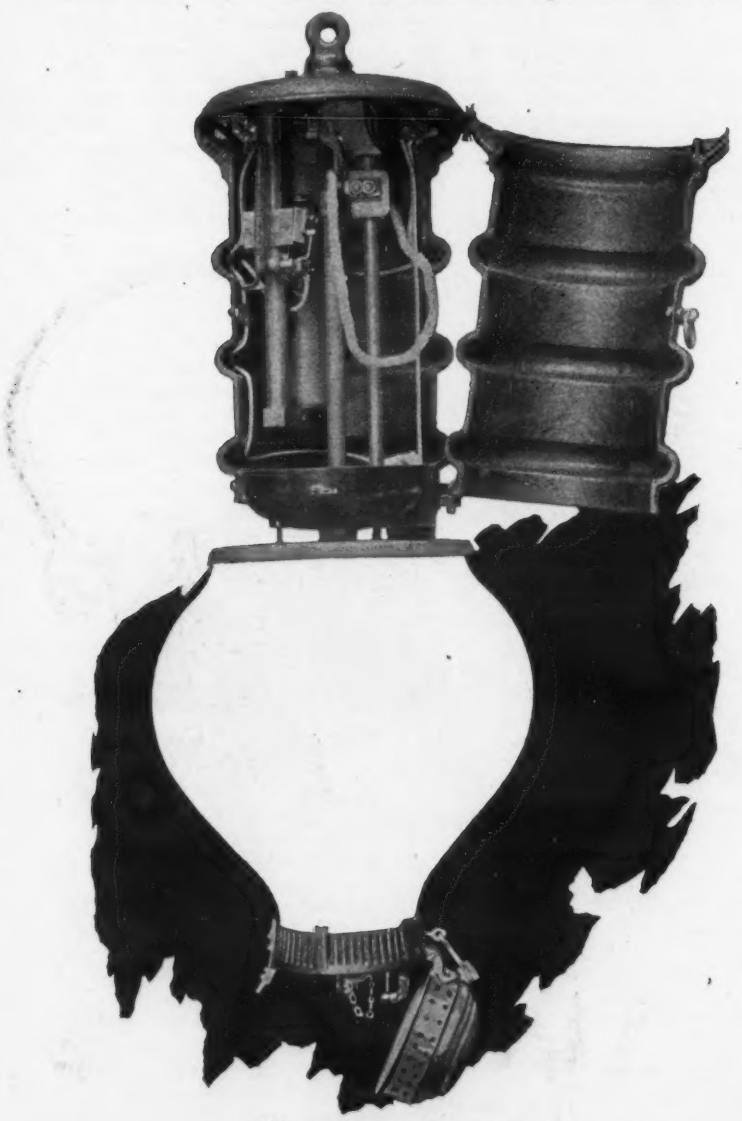
The Walker Company, Cleveland, Ohio, has brought out a new arc lamp and a new alternator, which, it claims, have sufficient merit to entitle them to favorable consideration in the trade.

The total length of the lamp is 34 1-4 inches, which is said to be shorter than any other lamp burning the same lengths of carbons under the same conditions. The workmanship employed in the production of this lamp is the very best. In appearance the lamp is a solid and substantial affair, but susceptible of highly decorative design, and it is the purpose of the company to shortly place upon the market a lamp of such finish that the most critical and æsthetic taste will be satisfied.

The mechanism of the Walker lamp has been designed with the idea of obtaining the steadiness of the rack feed and the simplicity of the clutch principles. The rod found in many other lamps has been dispensed with in this one and in its place is substituted a wheel of small diameter with an accurately turned rim, on the edge of which a clutch operates. The carbons are fed by a chain which drives a sprocket wheel mounted on the same spindle that carries the clutch wheel. Both carbons are fed, thus keeping the arc practically at a stationary level. The electromagnetic mechanism is very simple. The series bobbin and the shunt bobbin are separate and pull is in opposite directions on the same armature. The armature is cleft at its extremity, and this cleft travels over the wedge-shaped cores of the series and shunt bobbins, according as the pull of one or the other predominates. By this device the pull on the armature is rendered uniform throughout the travel.

Two distinct automatic cut-outs, which act under different conditions, are employed on the Walker lamp. They are both mechanical, and one is operated by the same mechanism that operates the carbons, and the other by the upper carriage, which supports the upper carbon. The resistance is made of specially high-resistance wire, which can be heated to redness without detriment.

This lamp is very convenient for trimming. The globe is readily lowered and is easily cleaned and replaced. One important feature in this



Mechanism of Arc Lamp.

connection is the fact that no part of the lamp frame is alive, which removes every element of danger to the trimmer or user.

The new Walker alternator, of which an illustration is given herewith, has been designed on the general outlines of the Walker generators. The machine is of the inductor alternator type, and in adopting this type the Walker Company has followed its usual practice of not exploiting new and untried types of machinery, but of adopting a type whose principles have become thoroughly familiar to the manufacturer and its advantages well known to the public.

The inductor is a solid iron casting keyed to the rotating shaft. There are no windings upon the rotor and no insulation to cause trouble.

The armature core, which is built up with annular laminations, has in-

New Alternator.

wardly projecting teeth, which support the armature coils. There are twice as many armature coils as there are inductor projections, and at any instant half the coils lie opposite these and half opposite the spaces between the inductor. The coils are thoroughly insulated in the process of construction and the sides and bottoms of the slots are lined with a composite insulation of the best materials before receiving the coils. This method insures the highest quality of insulation between armature windings and frame, and being upon the stationary portion of the machine is not subject to deterioration.

The inductor and armature together form a discoidal box, the stationary armature ring being the periphery. One side is closed by the projecting arms of the inductor, the other by a casting continuous with the armature ring and extending radially inward, leaving the necessary clear space between it and the inductor hub. Within this annular box, concentric with the shaft and securely bolted to the armature casting, is the exciting coil.

This machine presents the important advantage of accessibility to different parts for repair, and to dismantle it is a very simple operation. The top of the armature is removable, allowing the lifting out of the inductor and field coil together.

These machines are wound for single, two and three-phase transmission and any number of alternations. The machine represented in the illustration has a capacity of 1500 lights.

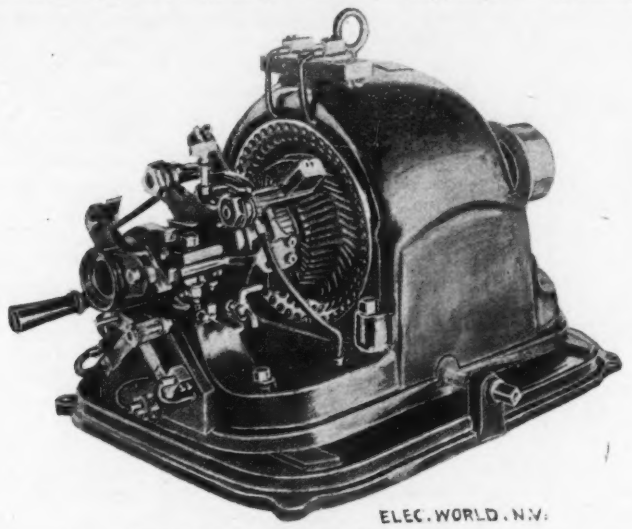
New Electric Motors and Generators.

For several months the Wagner Electric Manufacturing Company, St. Louis, Mo., has been applying most severe tests to a single-phase self-starting motor, which the company claims exceeds in efficiency and in all-round successful operation any polyphase motor on the market at the present time. These tests, it is stated, have conclusively established every claim made for the motor, both from mechanical and electrical standpoints. There are no limiting conditions to the application of the motor to power purposes. Wherever a single-phase circuit is available, whatever may be its frequency, this motor may be installed for the distribution of power or for incandescent or arc lights. No special transformers or auxiliary starting devices are required. A simple two-wire connection to the main secondary circuit of any standard transformer for ordinary lighting service constitutes the wiring entire.

The principle of the motor is very simple. A "primary" constitutes the stationary element corresponding to the field of a direct current motor, and the "secondary" is a movable element, and corresponds to the armature of a direct current machine. The secondary is constructed to operate in a double way. For starting, it is thrown in series with the primary by means of carbon brushes running on a commutator, and on attaining the running speed the connections are changed in a simple manner, the commutator being completely short-circuited and the carbon brushes lifted The motor then runs as a non-synchronous induction motor.

With reference to the operation of the motor great emphasis is placed on the starting torque secured. It is possible to pull up from rest to double the rate of load of the motor with a current only exceeding the load cur-

rent by 50 per cent. The motor very frequently runs up to the load service speed and operates under any and all loads with remarkable smoothness and quietness. Another feature of this machine which will prove attractive to the central-station man is that there are no pulsations of current in its operation. The motor is also unaffected by any momentary interruption in the current supply or a sudden change in frequency or voltage resulting from necessary station switching. The usual experience in operating a



SINGLE-PHASE, SELF-STARTING MOTOR.

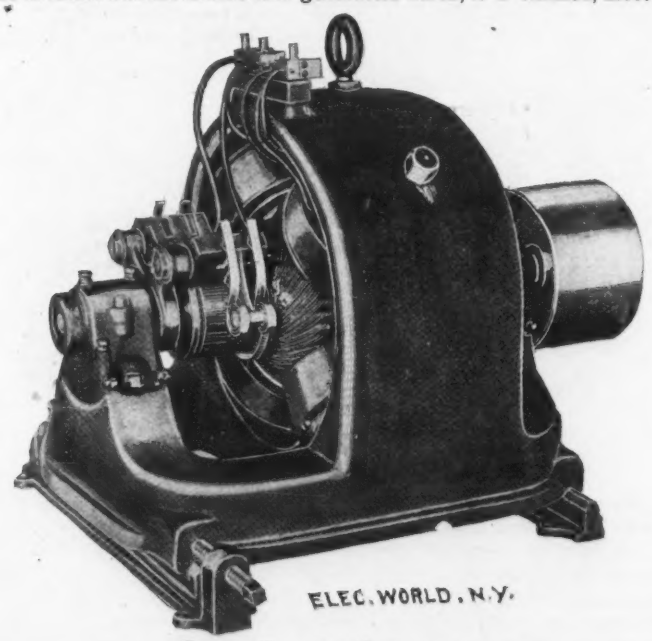
synchronous motor is that it stops whenever the circuit on which it is running is switched from one generator to another.

This motor is guaranteed to operate with equal effectiveness on frequencies of 16,000 and 7,200 alternations per minute, and at the present time the company is manufacturing four sizes, ranging from 1 1-2 hp to 5 hp. Larger sizes are in process of construction and will be placed upon the market at an early date.

The accompanying illustration represents one of these machines, which viewed from a mechanical standpoint are excellent in their design and finish. They are provided with self-aligning phosphor bronze bearings and oil reservoirs, and no detail in finish or construction has been overlooked. The handle by means of which the current is applied to the motor may be set in any one of three positions, "off," "starting" and "running."

Actual test results of a five hp motor built for a frequency of 60 cycles per second, as plotted from a brake test, shows a very rapid rise of the efficiency curve on light loads, and especially noteworthy is the high efficiency maintained up to a point of 50 per cent. overload. The drop in speed as the load increases is very small, which is a very important point in favor of the machine, while the high power factor at all loads is a unique characteristic.

The Wagner Electric Manufacturing Company has also just brought out a line of direct-current motors and generators which, it is claimed, meet all



DIRECT-CURRENT GENERATOR.

the requirements essential to the successful operation of apparatus of this class. In construction the frames are cast of the best high magnetic iron, and they have a general appearance of neatness and stability. The pole pieces in the larger sizes are separate, being cast from a superior grade of steel. The pedestals are also separate, being seated on supporting rackets of the main body casting, which are bored concentrically with the poles. This provides for absolute centering of the armature. The bearings are phosphor bronze self-aligning and self-oiling.

The armature is built up of discs punched from special steel sheets, carefully annealed, and the coils are buried below the surface in slots provided for the purpose. Means are also provided for affording effective cooling of the armature. The coils are machine wound and thoroughly insulated.

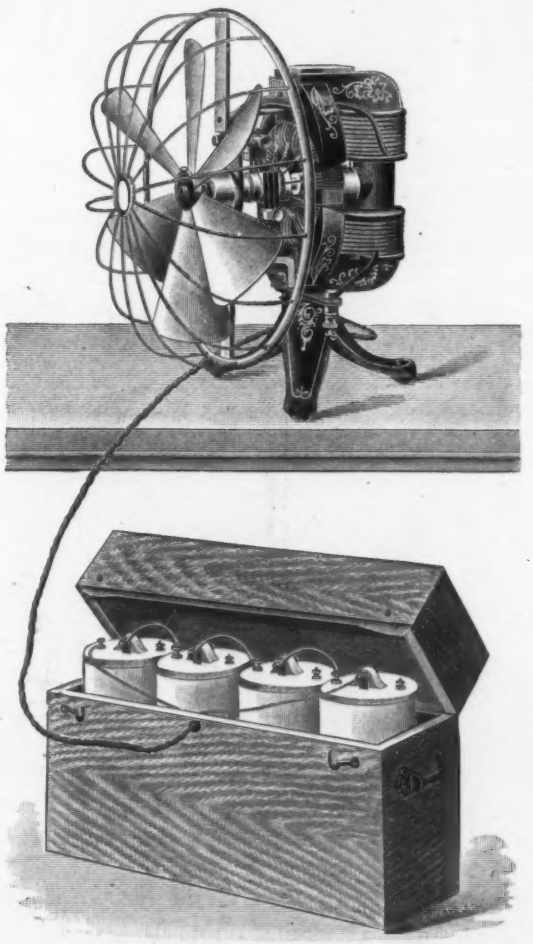
The commutator is said to be of peculiarly advantageous construction, and in the process of assembling a perfect and homogeneous commutator is the result. The brushes and brush-holders have been closely studied and worked out in this instance. The brushes are of the self-lubricating grade of best carbon, and the commutator soon takes on a very high polish under them.

The field coils of these machines are wound for both series and shunt excitation. The series coils are placed beside rather than on top of the shunt coils, thereby accomplishing more effective compounding. This form of winding, it is claimed, permits the best degeee of insulation and ventilation of the coils.

The generators are compounded to any degree desired, and unless otherwise specified are built to over-compound 5 per cent. at full load. The generators and motors are wound for 110, 250 or 500 volts, and each generator is provided with a rheostat for controlling the shunt field current and each motor with an automatic starting rheostat.

Battery Fan Motor Outfit.

The field for a serviceable battery fan motor outfit is a large one, and the Edison Manufacturing Company, New York City, has given as much attention to this subject as any other concern. For several years this company has been handling outfits of this character that have evidently given good satisfaction, and this year it is again in the field for the class of trade for which



BATTERY AND FAN MOTOR.

such outfits are best suited. Generally speaking, a battery fan outfit finds favor in places where electric light current is not available, and for this reason it finds its way into many homes and other places where the luxury of cooling breezes in warm weather would have to be foregone were such an equipment unavailable.

The nine-inch Edison fan motor outfit shown in the illustration has been much improved this season. The motor is more efficient and now runs the fan at about 900 revolutions per minute on a little more than two amperes of current when using the battery supplied with this outfit, which consists of four Edison Lalande cells, type "S," in a polished oak box. The greatest attention has been paid to the elimination of all unnecessary friction in the moving parts, and the motor, as it is now placed on the market, is claimed to be the most efficient battery motor that has yet been con-

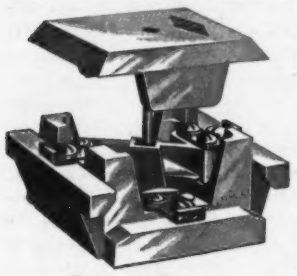
structed. It is provided with self-oiling bearings, and the workmanship is of the highest grade.

The ironclad outfit carries a seven-inch fan and is now provided with a guard. The batteries operating this motor consist of three Edison Lalande cells, type "S," and the motor runs at about 1200 revolutions per minute on this battery. As the motor is an efficient one the battery will run the fan for 150 hours before needing to be recharged.

This company has made a new departure this year in bringing out a nine-inch fan motor to run on the 110 to 120-volt direct current. This motor is similar in construction to the nine-inch Edison battery fan motor, but is wound for the electric light circuit, and will run right across the line. It is provided with three speeds, and will run 1400, 1700 and 2100 revolutions per minute respectively. It is of very high efficiency, the watts used at these three speeds being only 36, 48 and 60 watts respectively. The same high workmanship which characterizes all apparatus manufactured by this company is observable in the construction of this motor.

New Branch Block.

The branch cut-out illustrated herewith was especially designed to meet a very important requirement in branch blocks, namely, to avoid the escape of sparks when a fuse blows. The importance of this feature cannot be too strongly emphasized. It means prevention of fires under these circumstances, and the approval of insurance inspectors.



Branch Block.

This branch block is made by the Peru Electric Manufacturing Company, Peru, Ind. It is of porcelain, and well designed and constructed. The recesses are large, thus facilitating making the connections and replacing new fuses. The ears on the cover are extra large and fit in corresponding spaces in the base.

It is claimed to be one of the best devices on the market, and is meeting with well-deserved favor.

New Ceiling Fan.

The season for electric fans having arrived, manufacturers of these comfort-producing devices are active in their efforts to realize the best results. Among the many ceiling fans that this season has brought forth, the one

Direct-Current Ceiling Fan.

illustrated herewith deserves special mention. It is the product of the factory of Messrs. D. L. Bates & Bro., Dayton, Ohio, which firm has been engaged in the manufacture of these fans for the past five years.

The device illustrated is the firm's latest improved direct-current, four-blade fan with switch attachment. This attachment may be dispensed with, if desired, and an electrolier attachment of four or five revolving lights substituted, or both of them may be dispensed with. In the latter case the switch may be attached to the wall.

The motors contained in the basket are wound for 110, 220 or 500 volts direct current. The ornamental work is handsomely finished in nickel, oxidized copper or polished brass. These fans may be mounted on pedestals, if desired.

The firm has also placed upon the market a new alternating-current fan, which embodies several improvements on the fan produced last season. After making all these changes, the firm considers this fan a superior one. The bearings are self-oiling. These fans are furnished for circuits of high or low frequency and for 50 or 100 volts.

An Improved Steam Generator.

The demands of modern practice require quick, economical and efficient generation of steam in steam boilers, and to attain these results various devices and improvements have been produced. One of the most noteworthy of these is the Hascall Steam Generator, which is shown in the accompanying illustration. This generator, it is stated, effects a great saving in the use of fuel and produces a drier and more commercially profitable quality of steam than can be obtained by any other means, and at the same time absolutely prevents the formation of scale or sediment in the boiler, thus adding to the life of the same.

The generator is simple in its construction and principle of operation, and presents no change of conditions to the engineer as regards firing or running the boiler to which it may be applied.

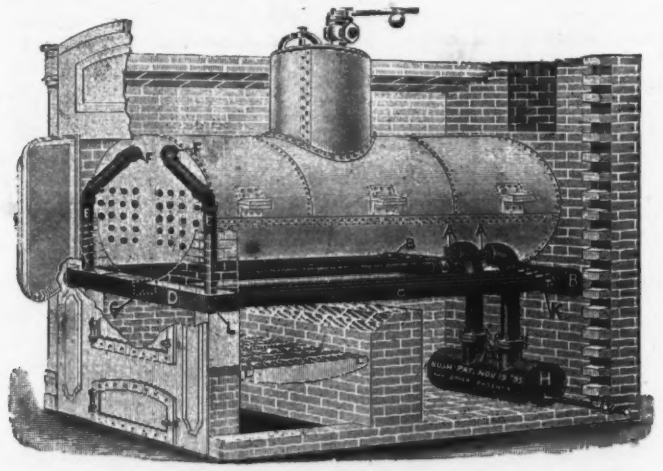
It is accessible at all times without disturbing the boiler setting, and the parts can be readily taken out, examined and replaced.

In attaching the generator, the rear head of the boiler is tapped and connections made with close nipples at *A A*, which communicate with back headers *B B*. Expansion joints, *K*, permit the tubes to expand and contract freely without injury in any way to the boiler connections. The tubes, *C*, are screwed at the front into the water box, or arch, *D*, which is divided by a partition as shown by the dotted line at *G*. The front riser tubes, *E E*, extend from the ends of the water box and enter the front head above the fire tubes and water level at *F F*.

Circulation of water commences as soon as the fire is started, entering from the lower portion of the boiler into the generator at *A A* and passing through the back headers, *B B*, thence forward through the tubes, *C*, which are immediately over the fire, into the water arch, *D*, and up the risers, *E E*, discharging at *F F* into the steam space of the boiler. This circulation is constant and extremely rapid and always in the same direction, viz., from the lowest point at the back end of the boiler to a point just above the water line in the front head. Such sediment as may be contained in the water tends to precipitate as soon as the temperature reaches the boiling point, and is carried in at *A A* by the rapidly flowing current, and, being of a greater specific gravity than water, continues on its downward course to mud drum, *H*, while the water turns to right or left, flowing through the piping as already described.

Thus, after heat has precipitated the foreign matter contained in the water, it is removed and isolated by reason of the very rapid circulation and gravity, and the boiler and the generator remain perfectly clean and free from scale. In fact, every point of the interior of the generator and boiler is thoroughly washed by the rapid circulation of the water.

In boilers where incrustation has already become a serious obstacle, the attachment of the generator it is claimed will remove the incrustation and absolutely prevent any further accumulation.



Application of the Steam Generator.

The generator is constructed of high grade material throughout and to meet all requirements of service for which it is designed, and is approved and insured by the representative boiler insurance companies.

From data at hand covering an extensive use of the Hascall steam generator, it appears that the steaming of a boiler is in every instance very much improved where the generator is attached (usually one-half less time than formerly being used to get up steam); that there is no difficulty in keeping steam at the pressure desired; that the saving in fuel ranges from 10 to 30 per cent., or, using the same quantity of fuel as formerly, the capacity of the boiler is increased in the same proportion.

This generator is manufactured solely by the Hascall Steam Generator Company, New York City, where models can be seen demonstrating its principle and showing its operation.

Automatic Electric Block Signal for Trolley Roads.

With a view to doing away with the annoyances incident to cars going in opposite directions meeting between turnouts on electric railways, the Automatic Block Signal Company, New York City, is introducing a novel and ingenious device, which is, in its outward appearance, illustrated below. The signal is automatic in its operation.

One of these boxes is placed on a pole near the turnout at each end of the "block" or section of single track. The box has two lenses on each side, the two upper lenses having green glass and the two lower ones red glass, with a group of lamps between each pair of lenses. Each box has wires running to automatic contacts on the in and out trolley wires of the switch. Two wires also connect the two signal boxes with each other.

The operation is as follows: The trolley wheel of a car on passing over the turnout to enter the block strikes the corresponding automatic contact, which lights the lamps that show the green signal in the signal box at the entering end and the red signal at the other end of the section.

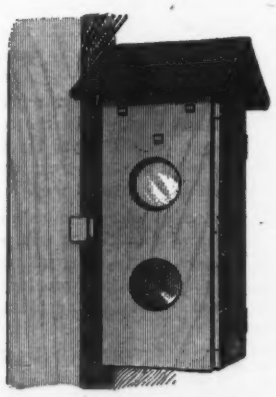
On passing out of the "block" or section the trolley wheels strike the automatic contact on the "out" side of the turnout trolley wire, and this shuts off the current from the lamps at both ends of the section. It will thus be seen that this block signal not only indicates at each end when a car is on the "block," but also the direction in which it is moving.

These signals have been in use by the Paterson (N. J.) Railway Company and by the New Jersey Electric Railway Company in Hoboken since October last, and have given perfect satisfaction.

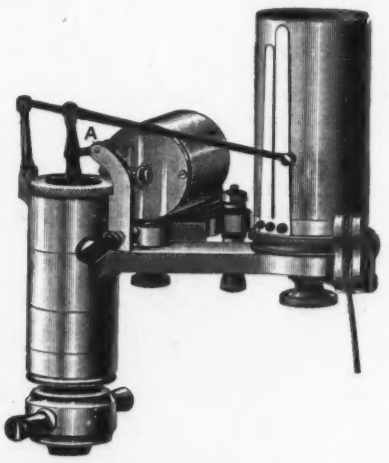
Steam Engine Indicator.

It is an established fact that in electric lighting and power plants, whatever affords improvement in any portion of the plant is always of the highest importance. The value of the steam engine indicator to central-station managers is too well known to require more than a passing mention, but a description of the Crosby indicator, manufactured by the Crosby Steam Gage & Valve Company, Boston, will be of special interest, showing, as it does, the recent important improvements which place this instrument in a position to meet the most exacting requirements of modern practice.

The cylinder proper of the indicator is constructed of a special alloy, which is exactly suited to the varying temperatures to which it is subjected, and secures to the piston the same freedom of movement with high-pressure steam as with low. The piston is of tool steel, while the piston rod is hollow to secure lightness. In order to obtain a correct diagram, the height of the pencil of the indicator must exactly represent in pounds per square inch the pressure upon the piston of the steam engine at every point of the stroke. Similarly, the velocity of the drum must, at every instant, bear a constant ratio to the piston speed. These essential features have been attained by a very ingenious adaptation of both the piston and drum springs. The greatest care has been exercised in the design and construction of the former.



AUTOMATIC BLOCK SIGNAL.



IMPROVED INDICATOR.

Several special designs of indicators are made to meet the demands for gas engines and very high-pressure service, and when desired they can be furnished in steel to resist the action of ammonia.

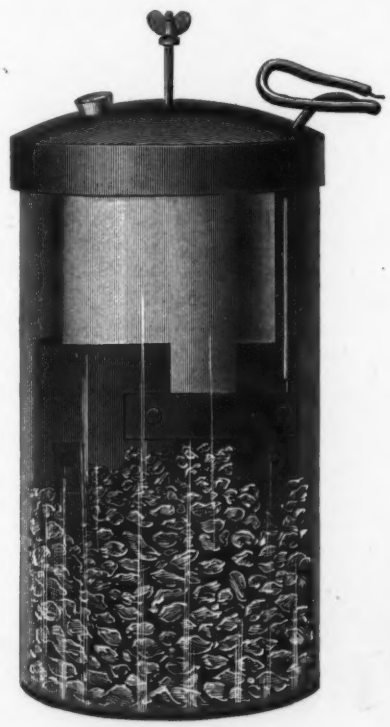
In order to decrease the number of assistants necessary in making very elaborate tests of power plants, the company has just placed on the market the Sargent electrical attachment, by means of which any number of instruments may be operated and diagrams taken, at the same time, by merely closing an electric circuit. The illustration shows the indicator fitted with the electrical attachment, which consists of an electromagnet operating an armature fitted with a latch which may be attached to the pencil arm. In using this system, each indicator is provided with an attachment, except that used by the operator, which is fitted with a circuit closer. The devices are all in series with a small battery, and the operation of taking a card by the assistant closes the circuit; whereupon each magnet draws the pencil mechanism against the paper and holds it in this position until the circuit is broken. A movement of the latch releases the pencil arm and allows it to be swung out of the way when it is desired to insert a new paper.

The Crosby indicators have been adopted by the United States Government as well as by other nations, and are very extensively used by engineers and power users.

Improved Gravity Battery.

We illustrate herewith an improved form of the well-known Gethins gravity battery, manufactured by the Burnham-Gethins Company, Boston, which combines some very excellent qualities that are worthy of attention. The battery is a modification of the Daniell cell, in which the ordinary porous cup is replaced by one of very large dimensions, having a glazed rim by means of which it is supported from the top of a 6 by 12 glass jar. The negative element is made of the purest zinc and is of a peculiar form, which presents a very large surface to the action of the solution, and also provides for a very even consumption of the material. A heavy rod running to the base of the metal serves as the connection, and the zinc can be used until completely consumed. The porous cup, which is practically indestructible, extends only partially into the copper sulphate solution, thereby preserving the gravity principle. In addition, it prevents the decayed portion of the zinc from coming in contact with the copper, thus eliminating any chance of a short circuit. The copper is cylindrical in shape and completely surrounds the cup, being supported by cross pieces. Its close proximity to the zinc diminishes the internal resistance very materially. A soft rubber cover fitting tightly over the top of the jar checks any evaporation or creeping of salts, thereby contributing very largely to the cleanliness of the cell. Six pounds of blue vitriol are used at a charge.

There are a very large number of cells in use to-day which have run for a year without renewal, demonstrating very forcibly the low cost of maintenance. The E. M. F. is said to be about 1.1 volts, and it remains so constant that the cell is often employed as a standard. When short-circuited it will furnish a current of two amperes. The principal features claimed for the Gethins cell are a high available E. M. F., a low internal resistance, a constant current, an absence of local action and noxious vapors, and cleanliness and ease of recharging.



GRAVITY CELL.

THE ZINC.

The battery is peculiarly adapted to charging accumulators for use in running dental drills, physicians' cauteries, mouth and nose lamps, besides sewing machines, electric organs and the like. A complete outfit enclosed in a handsome oak box can be furnished for this purpose, consisting of five cells of the Gethins battery, two chloride accumulators and a rheostat. These outfits are in very general use, and many of them have been employed from 12 to 16 months without renewal or alterations of any kind, at the same time furnishing a current of from 60 to 100 milliamperes. The Gethins gravity battery can be used for all kinds of closed circuit work on fire alarm, electric regulator, telegraph circuits, etc. It can be employed equally well on open circuits, and is particularly adapted to telephone service.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, May 17, 1897.

ELECTRICAL STOCKS.—This list shows little activity, and what few small changes in quotations that are recorded indicate that the business was small. General Electric common is a trifle lower in quotation, the sales of stock during the week amounting to 3,933 shares. Westinghouse issues are a little stronger, both common and preferred closing at a trifling advance over last prices.

TELEGRAPH AND TELEPHONE.—The telephone shares exhibited considerable strength last week, substantial advances being recorded in every stock. Bell is 10 points higher than it was at the time our last quotations were made, and both Erie and New England telephones experienced material advances over last quotations—amounting to about 5 points in the latter case.

ELECTRICAL STOCKS.	Par.	Bid.	Asked.
Chicago Edison Company	100	110	..
Edison Electric Ill., New York	100	110¾	111½
Edison Electric Ill., Brooklyn	100	105	..
Edison Electric Ill., Boston	100	147	148
Edison Electric Ill., Philadelphia	100	..	..
Edison Ore Milling	100	7½	10
Electric Storage Co., Philadelphia	100	17½	18
Electric Storage, pref	100	18½	19½
General Electric	100	30⅞	31¼
General Electric, pref.	100	..	70
Westinghouse Consolidated, com	50	22	24
Westinghouse Consolidated, pref	50	50½	51
BONDS.			
Edison Electric Ill., New York, con. 5s	105	112	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	97½	..
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	232	233½
American District Telegraph	100	.	35
American Telegraph and Cable	100	..	88
Central and South American Telegraph	100	124	127
Commercial Cables	100	150	..
Erie Telephone	100	65⅛	65¼
New England Telephone	100	106¼	108
Postal Telegraph Cable	100	97	..
Western Union Telegraph	100	76⅝	76⅞
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	19¼	19½
Brooklyn Rapid Transit	..	20	21
Brooklyn Traction	100	..	14
Brooklyn Traction pref	100	46	48
Buffalo Street Railway	100	70	72
Cleveland Electric Railway	100	..	.
Columbus Street Railway	100	43	45
Hestonville	100	49	50
Hestonville, pref	..	..	62½
New Orleans Traction	100	6	8
New Orleans Traction, pref	100	27	30
North Shore Traction	100	20	22
North Shore Traction, pref	100	76	79
Rochester Street Railway	..	12	14
Steinway Railway	..	45	50
Union Railway (Huckleberry)	..	..	103
Union Traction, rcts $10 pd	..	12¾	13
West End, Boston	100	76	76½
West End, Boston, pref	100	91¼	92
Worcester Traction	100	15	17
Worcester Traction, pref	100	90	93
BONDS.			
Brooklyn Rapid Transit 5s, 1945	100	75⅜	..
Buffalo Street Railway 1st con. 5s	100	*106½	108½
Cleveland Electric Railway 1st mtge. 5s	100	103	105
*Columbus Street Railway 1st 5s	100	94	96
Rochester Street Railway 1st 5s	100	..	100
Union Railway (Huckleberry) 1st mtge. 5s	..	105	107
*Westchester Electric 1st mtge. 5s	100	100	103

*With accrued interest.

The telegraph list was quiet, the advance in Western Union being within 1 point. The sales of this stock for the week amounted to 44,028 shares.

ELECTRIC TRACTIONS.—General quietness pervaded this list during the past week, and the changes in quotations were very slight. The list was entirely devoid of any feature. There was a more noticeable activity in the bond list. The net earnings of the New Orleans Traction Company for March this year increased $906 over the same during March last year, and for the three months ending March 31 the net earnings decreased $40,012, as compared with those of the same months in 1896.

EARNINGS.—The financial report of the Edison Electric Illuminating Company of New York, shows gross earnings for April of $206,142.93, an increase of $26,032.29, as compared with the same item for April, 1896, and net earnings of $100,844.50, an increase of $20,260.20. For the first four months of 1897 the gross earnings were $867,116.41, an increase of $89,446.36, as compared with the corresponding months last year, and net earnings were $425,814.56, an increase of $66,445.88. The report of the Edison Electric Illuminating Company of Brooklyn for the month of April, shows gross receipts, $67,985, an increase of $4,962, as compared with the gross receipts for April last year; operating expenses, $37,116, an increase of $839. After adding receipts from other sources and deducting taxes, etc., the net result is $28,568, an increase of $4,329. For the four months ending April 30, the gross receipts were $293,280, an increase of $18,293; operating expenses, $153,782, an increase of $3,492. The net result after adding miscellaneous receipts and deducting taxes, etc., leaves a balance of $128,397, an increase of $14,054.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, May 19, 1897.

THE GENERAL ELECTRIC COMPANY'S DIRECTORS.—At the annual meeting of the General Electric Company, which was held in Schenectady on May 11, the old board of directors was re-elected for the ensuing year. The board will hold its next meeting on June 14.

MR. COFFIN NOW A NEW YORKER.—New York's population has been augmented by one unit in the person of President Charles A. Coffin, of the General Electric Company, who, it is reported, has transferred his legal residence from Lynn, Mass., to New York. Mr. Coffin evidently wishes to share in the glory of being known as a citizen of Greater New York.

MR. COREY IN A NEW FIELD.—Mr. R. B. Corey will hereafter represent the Simplex Electrical Company, Boston, in the Middle and Coast States, for which concern he has taken the agency. Mr. Corey's office is at 711 Havemeyer Building, New York, and the acquisition of this gentleman to the Simplex Company's force militant will no doubt be felt in a material way.

ELECTRIC LIGHT ON FERRY BOATS.—The Alexander-Chamberlain Electric Company has about completed the equipment of four Staten Island ferry boats with electrical light plants. Peculiar arrangements of apparatus have been necessitated by the extremely low and varying steam pressure, ranging from 23 to 30 pounds. One odd feature in such small lighting plants is the use of pump condensing apparatus.

THE AMERICAN INSTITUTE OF MECHANICAL ENGINEERS will hold its semi-annual meeting at Hartford, Conn., from May 25 to May 28. The professional session for the reading of papers will be held at Unity Hall, the convention office and headquarters, however, being at the Allen House. The Pope Manufacturing Company has offered to the society several of its new electric motor carriages for the free use of the visiting members.

THE WARD LEONARD ELECTRIC COMPANY'S FACTORY BURNED.—On the night of May 20, Hoboken, N. J., was visited by a large fire, which caused a loss of nearly $1,000,000. Among the buildings destroyed was that in which the Ward Leonard Electric Company had its factory. The structure was five stories high, about 700 feet long and 200 feet deep, running the entire length of the block on Washington Street, between Twelfth and Thirteenth Streets.

ELECTRIC LIGHTS ON SEVENTH AVENUE.—A petition has been presented to the Senate, having for its object the substitution of electric light for gas light on Seventh Avenue, from 110th Street to the Harlem River. This avenue, within the limits named, is one of the principal drives in the city, and constitutes one of the northern outlets of Central Park. It is very broad, and the introduction of electric lights would be much appreciated by those who drive and those who reside along the avenue.

MR. N. M. GARLAND, well known among electrical people in this vicinity, has recently connected himself with the Manhattan Electric Light Company,

of this city, as its general agent. Mr. Garland still continues for the present his office at 136 Liberty Street, where, in addition to other business, he represents the Emerson Electric Manufacturing Company, St. Louis, Mo. Mr. Garland expects to eventually devote his whole time and attention to the development of the Manhattan Company's business in this city.

MR. JAMES I. AYER is one of the few prominent electrical men who visited New York with a view to attending the dinner of the American Institute of Electrical Engineers. Mr. Ayer is now general manager of the American Electric Heating Corporation, Boston, Mass. A very interesting and unique novelty recently brought out by Mr. Ayer's concern is a sectional enameled rheostat, whose particular virtues Mr. Ayer takes great pleasure in extolling. He carries with him a little sectional tablet in his vest pocket.

ELECTRIC ELEVATOR MACHINES.—At the meeting of the Electrical Section of the Franklin Institute on Tuesday evening, May 25, Mr. Joseph Sachs, of New York, will deliver a paper on "Electric Elevators," which will include a general resume of various appliances and apparatus used in the construction and operation of such machines. The paper will be illustrated by lantern slides. There will also be an exhibition of and discussion upon rheostats. Mr. C. E. Carpenter, of the Ward Leonard Electric Company, will open the discussion.

THEFTS OF TELEGRAPH WIRE.—The Postal Telegraph Company has on several occasions recently suffered serious interruptions on its Boston lines through the theft of wire from the poles. The thief was apprehended a few days ago with some of the stolen wire in his possession. His name is George Abbott, and he is charged with having stolen 14,800 feet of wire. He cut the lines on seven different occasions, taking therefrom each time lengths varying from 1,000 feet to 2,600 feet. Abbott sold the stolen wire, which was of copper, to junk dealers.

WELL-MERITED PREFERMENT.—Mr. Frederick E. Dolbier has been appointed general agent for this district of the General Incandescent Arc Light Company. Mr. Dolbier was formerly connected with the construction department of the same company, and previous thereto had wide experience in general construction work, extending over some seven or eight years. All the apparatus manufactured by the company is handled by Mr. Dolbier, including the Bergmann incandescent arc lamps. The peculiar ability which Mr. Dolbier possesses for this class of work will undoubtedly brng very excellent results.

DEMONSTRATION OF VACUUM TUBE LIGHTING.—Mr. D. McFarlan Moore will on Thursday evening, May 27, give a demonstration of results obtained by him in vacuum tube light since his exhibitions before the American Institute of Electrical Engineers and during the electrical show in this city, in May, 1896. The exhibition will take place at the laboratory of the Moore Electrical Company, 52 Lawrence Street, Newark, N. J., and will begin promptly at 8:10 o'clock. The train will leave the Pennsylvania ferry station in New York at 7:30 and, returning, will leave Newark for New York at 10:04.

NEW OFFICERS OF THE BROOKLYN INSTITUTE.—The annual meeting of the Department of Electricity of the Brooklyn Institute of Arts and Sciences was held on the evening of May 15, and the following named gentlemen were elected officers for the ensuing year: President, James Hamblet; vice-presidents, William S. Barstow and J. P. Wintringham; secretary, Henry T. Weed, Executive Committee—James Hamblet, Charles E. Emery, J. P. Wintringham, Henry T. Weed, William S. Barstow and William D. Sargent. Prof. William A. Anthony, Ph. D., delivered a lecture on "The Control of Elevators Operated by Electricity."

ELECTRIC CARRIAGES BECOMING VERY POPULAR.—The twelve electric hansom cabs operated by the Electric Carriage & Wagon Company are now in active service, and the station is taxed to its utmost to fill calls that are coming in continually. The cabs are attracting a great deal of popular attention, and passers-by, without having any intention of riding about the city, are at once interested with the coming conveyance and usually want to take a ride. Mr. C. J. Harrington has recently been appointed superintendent of the New York depot, and under his active supervision a number of important and successful changes have been or are about to be made. Several additions to the carriages now in service are expected shortly, among which will be a very elegant electrically propelled brougham.

POLICE AND FIRE TELEGRAPH SUPERINTENDENTS.—The Executive Committee of the International Association of Police and Fire Telegraph Superintendents held a meeting at the Clarendon Hotel, Brooklyn, N. Y., on May 15, at which it was decided to hold the next convention of the Association at Nashville, Tenn., on Tuesday, September 8, next. The Old-Time Telegraphers' and the United States Military Telegraphers' associations will hold their next meetings at the same time and place. The Police and Fire Telegraph Superintendents' Association, according to the report of Treasurer Bosch, is in a good financial condition, and is steadily growing in numbers. Mr. J. W. Aydon, of Wilmington, Del., was elected a member of the Executive Committee. President Frank C. Mason is doing some good work in behalf of the Association, which is a potential factor for good in the police and fire services in the cities represented by the membership. It was organized last September in Brooklyn, N. Y.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., May 19, 1897.

GOOD BUSINESS IN RAILWAY SUPPLIES.—The Bibber-White Company, Boston, reports business as very active, so far as it is concerned. This company at present is doing a fine line of business in railway supplies, and is furnishing for several electric roads complete lines of equipments.

ARTISTIC DISPLAY OF FAN MOTORS.—This is the season when the public is looking about for electric fans. People passing through Federal Street, Boston, cannot help stopping to examine the very artistic display of electric fan motors in the windows of the Pettingill-Andrews Company. The fans are of the well-known Lundell type, manufactured by the Interior Conduit & Insulation Company, and have either nickel-plated or highly-polished brass blades.

SOME BOSTON HUMOR.—Boston has always been criticised for its conservatism, its business men for hesitancy of conclusion, and, in fact, generally for absence of life, quickness, etc.—the application even of the sharpest pointed pin failing to excite. The following recent incident, however, should serve as an exception to this impression. It occurred in a prominent electrical supply establishment of Boston and at the busiest hour of the day. Said one of the partners to the other, desiring to ascertain the number of miles of wire on a nice order received by the morning's mail, "How many miles in Portland (Me.), Ed?" "One hundred and fifteen" (without a smile), was the quick reply, which represented the mileage of that city. Smiles then came quickly all round, and the huge frame of Chas. A. White came near crushing hard the diminutive but good-natured and lively C. E. Bibber.

WHO GOT THE CONTRACT?—The electrical centre of Boston during the past week took on quite a little of the "old-time" life. The two local electric lighting companies and a prominent department of the city were in the market for wire and cables. It must indeed have required some clever work on the part of officials to withstand the irrepressibility of Manson and Ham of the Okonite Company, the suavity of Henry D. Stanley, now of the National Conduit & Cable Company, the effectiveness of George L. Wiley, of the Standard Underground Cable Company and the forcefulness of W. R. Brixey. All could not possibly have won, yet when in the evening all these popular gentlemen were seen together at a prominent hostelry, from their appearance and the goodly feeling which seemed to prevail among them, it could not have been guessed which had come out victor; neither would the usually complacent countenances of Capt. William Brophy, of the Wire Department, of Boston, and Capt. Browne S. Flanders, of the Fire Alarm Department, tell the story.

BUFFALO AND NIAGARA FALLS NOTES.

NIAGARA FALLS, N. Y., May 18, 1897.

INDUCTION ROTARY TRANSFORMER INSTALLED.—The Westinghouse Electric & Manufacturing Company has just installed at the works of the Niagara Electro-Chemical Company, in this city, what is said to be the first induction rotary transformer ever built for commercial use. It was thoroughly tested yesterday, and was found to work perfectly. The installation and testing were under the supervision of Mr. W. K. Dunlap, who has charge of all the Niagara Falls work of the Westinghouse Company.

AN OPPOSITION ELECTRIC ROAD.—The Tonawanda Electric Railroad sprung a surprise on the Niagara Falls Council last night by filing a formal application for a franchise to lay trolley tracks on the streets of the city. The application was signed by the president of the company, Mr. James H. Rand, and outlined the proposed route of the line. This is the electric road proposed some time ago, to be built in opposition to the Ely line, running from Buffalo to the Falls. A lively fight is expected between the companies on June 7, when a public hearing will be granted in the matter.

PITTSBURG NOTES.

PITTSBURG, Pa., May 17, 1897.

THE CARTER ELECTRIC COMPANY has secured the contract for wiring the new Carnegie Library, now in course of construction at Homestead, and this same company is also engaged in the installation of an extensive watchman's clock system in the Pennsylvania State Institution for the Blind at Polk, Pa.

TO ENLARGE ITS STEAM PLANT.—The Allegheny County Light Company will soon let the contract for an addition to its boiler house that will provide space for duplicating its present boiler equipment. This addition will replace the old building that is now occupied by the storeroom, repair shop, and offices of the operating department of the company, and will fill all the ground between the present boiler house and Twelfth Street. The offices, shop and storeroom will eventually be housed in new quarters, to be provided at the Thirteenth Street end of the engine and dynamo room.

THE FIRST TELEPHONE COMPANY TO BACK DOWN.—The East Pittsburg Telephone Company, which recently issued circulars offering telephone service at $3 and $2 per month, last week sent out the following notice: "Owing to the decision just rendered by the Supreme Court of the United States in the Berliner patent case, it becomes necessary for us to withdraw the proposal made in ours of April 22, 1897, for the furnishing of telephone service in Pittsburg and Allegheny, as we feel that it will be impossible for us to furnish the character of service agreed upon without infringing on the patent referred to, which, according to the information from our attorneys will prohibit us from using a battery transmitter." The officials of the Home Telephone Company state that the Berliner decision will have no effect upon the Home Company, and that it will proceed to carry out its plans without change.

St. Louis Notes.

St. Louis, Mo., May 17, 1897.

RECEIVER APPOINTED.—Ex-Senator G. A. Wurdman, of Old Orchard, has been appointed receiver of the Olive Branch Electric Light Company, Ferguson, Mo. (St. Louis County).

NORTH AND SOUTH BELT LINE.—The Lindell Railway System is to have a north and south belt line as a feeder to its numerous extensions into St. Louis County. The terms and conditions have been agreed on, and a franchise will be granted.

NOT AFRAID OF THE BERLINER DECISION.—The Kinloch Telephone Company, of this city, which has a capital of $1,500,000, has up to date expended $200,000 in conduits, and contracted for over $100,000 more since the Berliner decision. The company now has 580 men in its employ.

NEW SWITCHBOARD ORDERED.—The Kinloch Telephone Company has contracted with Milo G. Kellogg for a new switchboard, which is an improvement over the old one. The new board will provide for 6160 drops, but it may be enlarged at any time. The cost will be over $213,000, and it requires a year to build.

PURCHASED TWO ELECTRIC ROADS.—The Lindell Railway Company recently bought out the Midland Electric Railway and the Clayton & Delmar Railroad. There is still talk of the absorption of the St. Louis & Suburban. If the Lindell can get it at a fair figure it has the money as well as the inclination to make it a part of its system.

A NEW ELECTRIC ROAD was incorporated a few days ago, with the following stockholders, all St. Louis men: Geo. W. Baumhoff, Charles Hodgeman, Samuel Barnes, John L. Meyers, Luther A. Hardy, Lou O. Hocker. The capital stock is $120,000. It will be an electric road, to carry either passengers or light freight between Clayton and Creve Coeur Lake.

CAPT. McCULLOCH ELECTED PRESIDENT.—At a meeting of the stockholders of the Jefferson Avenue Railroad Company, held May 10, Capt. Robert McCulloch, general manager of the Hamilton syndicate lines, was elected president, to serve for the ensuing year. Capt. McCulloch takes the place of Mr. P. C. Maffit, formerly president of the Missouri lines, whose interests were recently purchased by the Lindell Railway Company.

EXTENSIVE FRANCHISE.—A bill was introduced in the House of Delegates recently, granting the General Electric Traction Company, of St. Louis, a franchise to build a system extending from the heart of the city to the outermost limits in several directions. The bill includes a certain central route with five branches. The franchise is to run for five years, and the company promises to pay the city the sum of $250,000 in annual installments of $50,000. It also provides for a five-cent fare and general transfers.

Pacific Coast Notes.

San Francisco, Cal., May 7, 1897.

FRANCHISE SOLD.—The Los Angeles (Cal.) Council has awarded the Mateo Street railway franchise to James C. Kays, whose bid for the same was $5,611,

UNDERGROUND WIRES.—The San Francisco Board of Supervisors, at a late meeting, expressed themselves as being in favor of requiring all future installations, for lighting, telegraph and telephone purposes, to have the wires laid underground in the downtown districts.

POWER TRANSMISSION LINE OPENED.—The Power Development Company's Bakersfield (Cal.) transmission plant was recently tested and is now in successful operation. General Electric generators, driven by Girard turbine wheels, transmit current a distance of sixteen miles.

TO DEVELOP A WATER-POWER TRANSMISSION SYSTEM.—The Los Angeles Edison Electric Company has filed with the Board of Supervisors a certificate of creation of bonded indebtedness amounting to $500,000. The idea is said to be that of developing a water-power electric transmission system to supply light and power.

SPRECKELS' NEW POWER PLANT.—Consulting Engineers Hasson and Hunt have issued the specifications for the power plant for the new Claus Spreckels Building, San Francisco. Included in the equipment specified are: Boilers, 450 hp; generators, capacity, 450 kw; three 150-hp engines; also, a number of pumps for elevator service and other purposes. Three Crane hydraulic elevators will be installed.

TELEPHONE EXTENSIONS.—The Sunset Telegraph & Telephone Company has in course of construction the following lines in California: From Redding to Marysville, a 162-pound copper loop; poles 24 feet long, 9 x 9 butts, 6 x 6 tops; distance, 124 miles; Visalia to Bakersfield, a 172-pound copper loop; Santa Rosa to Ukiah, a 172-pound copper loop and poles as above; Modesto to Newman, a single 172-pound copper wire and poles; San Francisco to Sacramento (the direct line), an additional 435-pound loop, on old pole line. The company's wires in Oakland, Cal., have just been connected with the new cable recently laid between that city and San Francisco. There are now sixty wires running across the bay.

POWER HOUSE CONTRACTS LET.—The contracts for the electric power house, which is to supply the new Claus Spreckels Building, San Francisco, were recently let by Messrs. Hasson & Hunt, consulting engineers. The electric equipment, consisting of three MP 100-kw generators, switchboard equipment and a variety of station apparatus, was awarded to the General Electric Company. Slotted armatures and laminated field-magnet cores are specified. Messrs. Charles C. Moore & Co. received the contract to supply three 150-hp Babcock & Wilcox boilers. The Risdon Iron Works will furnish three Ball engines, of a vertical type, to which the generators will be directly connected. The generating station will be located in an annex 69 feet in height, at a distance of 165 feet from the main structure. There will be room for the installation of an additional engine, boiler and dynamo, of 150-hp capacity, when needed. The mains, which will supply current for lighting and to operate the presses of the "Daily Call," will be carried in conduits through a tunnel connecting the main building with the annex.

Canadian Notes.

Ottawa, Ont., May 17, 1897.

ELECTRIC CARS OVER THE NEW VICTORIA BRIDGE.—The question as to what company has secured, or will secure, the right to run electric cars over the new Victoria bridge, about to be constructed over the St. Lawrence River at Montreal, is exciting some interest. Not long ago Mr. A. J. Corriveau, who, with a number of New York and Canadian capitalists, has about completed arrangements for the building of an electric railway system to radiate from Montreal all through the eastern townships, declared this electric system was to run from and into Montreal over the Victoria or some other bridge. It is said the Grand Trunk may decide to run its own electric cars over the bridge.

QUEEN VICTORIA WILL TOUCH THE BUTTON.—Arrangements are being perfected by which Her Majesty Queen Victoria will start the electric works of the Lachine Hydraulic & Land Company, at Lachine Rapids, Que., on or about jubilee day. This will be done by means of the Atlantic cable, Her Majesty simply touching the electric button at Windsor Castle. The company already has fifteen water wheels ready to run, and expects to have twenty-four in the course of a week. The generators to be placed by the General Electric Company, Schenectady, N. Y., and the transformers, from the Wagner Electric Manufacturing Company, St. Louis, are already on the spot. This is said to be the largest installation in the British dominions, and second only to the one at Niagara Falls. The company has already laid over eighty miles of conduit in the city of Montreal. Five million square feet of the bed of the St. Lawrence River will be made dry land.

ELECTRIC POWER IN A FACTORY.—A broad field for the application of electric power to manufacturing purposes is being investigated by the Consumers' Cordage Company, at its works in Dartmouth, Nova Scotia. Several machines, among the number being two spinning jennys, are being fitted up with electric appliances for an experiment in the use of electricity as a motive power in the place of steam. The result of the experiment will be watched with the greatest interest, as the success of such a test in a large manufacturing establishment like the Dartmouth Rope Works is calculated to revolutionize all kinds of manufacturing industry. If the experiment is a success, and electric power proves to be as effective and much cheaper than steam, it is certain to be gradually applied to the entire works. It will also be possible to connect the rope works with the docks and the Dartmouth branch of the Intercolonial Railway by an electric road, and thus save the large cost of hauling, which is at present involved in shipping manufactured goods and receiving raw material.

English Notes.

(From Our Own Correspondent.)

London, May 5, 1897.

A BIG DYNAMO SET.—The Electric Construction Company has just received an order from the Manchester Town Council for a continuous-current multipolar dynamo coupled to a Musgrave engine of 2,500 horse-power. This is said to be by far the largest combination of the kind yet ordered in England.

MUNICIPAL ELECTRIC LIGHTING.—As I stated in a recent letter, the City Fathers of Sheffield have decided to purchase the local electric lighting undertaking upon very advantageous terms, so far as the shareholders of the company are concerned. An agitation is now being commenced in Birmingham with a similar object in view. Birmingham, I may say, was a generation ago the leading example of thorough municipalization in England, but it has of late years somewhat fallen behind the times, and not only are the tramways leased to a Canadian syndicate, but the electric lighting has for some time past been rapidly developing without any effort on the part of the municipal authorities to acquire it by purchase before it attains the dimensions of a "gigantic monopoly," that bogy of all ardent municipalizers.

ELECTRICAL ENGINEER VOLUNTEERS.—Some of your readers may recollect that in the eruption of patriotism which occurred on the occasion of the telegram sent by the German Emperor to President Kruger in June, 1896, the then president of the Institution of Electrical Engineers was so far moved as to suggest the formation of a corps of Electrical Engineer Volunteers, and although the idea did not appeal to some captious critics, among whom I must number myself, it has appealed to the War Office and a large proportion of the members of the Institution, the result being that on Tuesday, April 27, the London "Gazette" contained the following announcement: "Her Majesty has been graciously pleased to approve the formation of a volunteer corps to be designated 'The Electrical Engineers, Royal Engineers (Volunteers).'" I understand that the historic fort of Tilbury will be the headquarters of the new corps, and already some 250 members of the Institution of Electrical Engineers have sent in their names as willing to join, and that it is proposed that Lord Kelvin shall be honorary colonel.

TELEGRAPHIC REFORMS.—The Post Office is now making a profit of over three and one-half millions sterling. This is considered by some to be an excessive profit, and after years of pressure the Chancellor of the Exchequer in his budget speech, on Friday last, announced several postal and telegraphic concessions to the public. Perhaps the most important are the reduction of the porterage charges, which press rather heavily upon the senders and receivers of telegrams in rural districts. In future telegrams will be delivered free of cost within a radius of three miles from any telegraph office, and afterward will be delivered at the rate of 3d. per mile, counting from the telegraph office door. Another grievance has been the large guarantee required by the Post Office in rural districts where there is no probability of a remunerative traffic arising within a measurable distance of time. In future the Post Office will reduce this guarantee to one-half, and when the time of the guarantee has expired the office will be continued open even if it still remains unremunerative, provided it can be shown that it is of any service whatever to the public at large.

A NEW GAS ENGINE CYCLE.—For some time past a member of "The Electrician" staff, Mr. Tremlett Carter, has been working out the details of a new gas engine cycle, which he has invented, and which is designed to effect improvements where the Otto cycle is principally defective. These developments were completed some two months ago, and were then protected by patents, it being intended to acquire further foreign patents immediately. The principal improvements in the Otto cycle which this new cycle is directed to effect, are: First, the useful recovery of heat wasted in the jacket and the exhaust, which in the Otto cycle is represented by some 70 to 80 per cent. of the total heat; second, the abolition of the idle revolution without the use of two working cylinder ends and without the use of a pump, for compressing the explosive mixture; third, an increase in the power obtained from a given sized cylinder; fourth, prompt and efficient regulation without omission of explosions; and, fifth, a means of increasing the power of an engine considerably beyond the normal, to enable it to take extra heavy loads for short intervals. The consumption of gas by an engine working on the new cycle is expected to be from 50 to 60 per cent. only of the gas consumed in the Otto cycle, the thermal balance sheet showing a thermo-dynamic efficiency of 40 per cent. for engines of moderate size.

AMERICAN CONTRACTORS AND ENGLISH ELECTRICAL RAILWAY CONTRACTS.—The following passage of arms which occurred in the House of Commons last week will probably be of considerable interest to American readers. Sir Howard Vincent asked the president of the Board of Trade whether he was aware that the whole of the rolling stock required by the Waterloo & City Railway had been ordered from America, and whether he would consider the making of a new standing order directing that companies having the control and construction of new railways should be bound to have a portion of the goods supplied for the undertaking from English firms; to which the president of the Board of Trade replied as follows: "No. sir; I am not prepared to suggest a new standing order. With regard to the particular instance referred to, I am informed by the company that the order has been placed with an American firm for the reason that no less than seven selected firms were invited to tender and not one of them was able to complete and deliver the rolling stock in question, consisting of only twenty-two coaches, the wheels and axles for which are to be supplied by English and Scotch firms, within the time required by the company for the opening of the railway." To this, Sir Howard Vincent remarked that as he understood the contract was not actually signed, he would ask the president of the Board of Trade to use his influence with the company so that the directors might be "brought to a proper sense of their duty to English trade." To this the president of the Board of Trade remarked that he did not see it was obligatory upon railway companies "to employ people who cannot deliver goods within a specified time."

A METER PATENT CASE.—Some little time ago Messrs. Chamberlain & Hookham, who exploit the Hookham meter, brought an infringement action against Messrs. Johnson & Phillips, who exploit the Perry meter, and judgment was given in the Court of First Instance on Saturday last. Probably the principle of the Hookham meter is well known to your readers, but I may briefly say that it consists in passing the current to be metered across a disc placed between the pole-pieces of a permanent magnet, the retarding force being the Foucault currents generated in another disc by another set of permanent magnets. There is little doubt that the mere principle of this was enunciated in a very early patent by Professors Ayrton and Perry, and that more recently Professor Perry made a very pretty application of it, and embodied it in a meter patent the rights of which are sold to Messrs. Johnson & Phillips, but the Judge held, and I think quite rightly, that the early patent was not so much a patent as a statement of the theories and principles involved, and quite useless to enable a workman to make a meter, and he did not therefore consider the early patent an anticipation of Mr. George Hookham's specification. On the other hand, he considered that the Perry meter was a distinct expansion of the suggestions made in Mr. Hookham's specification, and therefore was an infringement of his patent. Whether this is good law or not, I am unable, as a layman, to say; but it is certainly substantial justice, since Mr. George Hookham has been indefatigable, not only in the mere business of pushing his meter, but in perfecting those innumerable details which make all the difference between a meter which works on paper and one which hopelessly misbehaves itself when installed in a consumer's premises.

GAS ENGINES vs. STEAM ENGINES AT COATBRIDGE.—Some particulars of the working costs of Coatbridge Electric Supply Station have been submitted to me by Mr. A. J. Lawson, of the County of London & Brush Provincial Electric Supply Company, and are very instructive as regards the comparative working costs of gas and steam driving. As your readers are probably aware, the Coatbridge station was started entirely as a gas-driven station in 1894, but in the middle of 1895 the gas plant was abandoned and a steam plant substituted, and the latter has been working ever since. Comparing the cost of fuel in the two cases, I find that gas engine fuel cost 2.54d. per unit generated as against only 0.5855d. per unit generated for coal for the steam boilers. This comparison, however, is largely influenced by the fact that the gas engines were supplied with gas from a generator consuming anthracite costing 18s. per ton, whereas the steam boilers are now fired with cheap coal costing only 4s. 6d. per ton. Accordingly I find that whereas last year 944 tons of coal were consumed, in 1894 there were only 294.4 tons consumed, representing respectively 35.3 and 26.4 pounds of coal per unit generated, figures which show that although the gas cost more, the additional cost arose from the higher price and not from a higher consumption, the consumption indeed being considerably lower. These figures are instructive and tend to throw light on the prospects of gas-driven stations for electric lighting and traction purposes and comparing figures as they have been submitted to me, I am inclined to think that the failure of gas engines at Coatbridge was due rather to local conditions than to any inherent and necessary defect in the system of working by gas-power. On the other hand, it must not be forgotten that both at Belfast and Morecambe, where gas engines were at first tried, these are now being abandoned and steam plant is to be substituted.

General News.

NEW INCORPORATIONS.

THE CELINA TELEPHONE COMPANY, Celina, Ohio, has been incorporated with a capital stock of $6,000.

THE JOHN M. KLEIN ELECTRICAL WORKS, San Francisco, Cal., has been incorporated with a capital stock of $50,000. The directors are J. M. Klein, J. T. Stone and others.

THE MUTUAL BENEFIT LIGHT & HEAT COMPANY, San Francisco, Cal., has been formed by W. P. Harrison, P. S. Lawrence and others. The capital stock is reported to be $500,000.

THE ENTERPRISE POWER, LIGHT & HEAT COMPANY, Chicago, Ill., has been organized with a capital stock of $100,000. Among those interested are Howard B. Cook, Fred. L. Boruff and Richard S. Hopkins.

THE SUBURBAN ELECTRIC LIGHT COMPANY has been incorporated at Hempstead, L. I., N. Y., with a capital stock of $25,000. Those interested are Frank M. Frary and Harrison G. Ramsdell, New York City.

THE NEW MEXICO RAILWAY & COAL COMPANY has been incorporated at Trenton, N. J., with a capital stock of $4,000,000. The directors are John Davis, John Kelly and Edward Mowbray, of Brooklyn, N. Y.

THE WYANDOTTE ELECTRIC LIGHT COMPANY, Kansas City, Mo., has been incorporated with a capital stock of $50,000. Those interested are John B. Scroggs, William T. Atkinson, John Bloomquist and John C. Horton.

THE RIVERHEAD, QUOGUE & SOUTHAMPTON RAILROAD COMPANY, Riverhead, N. Y., has filed a certificate of incorporation with the Secretary of State. The road which it is intended to construct will be six miles long.

THE CITIZENS TELEPHONE COMPANY, Dayton, Ohio, has been incorporated with a capital stock of $100,000. The incorporators are John T. Barlow, John F. Ohmer, M. A. Nipgen, A. N. Ridgway and William F. Breidenbach.

THE FRANKLIN, SOMERSET & KENNEBEC RAILROAD COMPANY, Farmington, Me., has been organized with a capital stock of $100,000. Among those interested are Leonard Atwood, W. H. Ambler, W. D. Hewitt, all of Philadelphia.

THE BAY CITY ELECTRIC LIGHT & POWER COMPANY was recently incorporated in San Francisco, Cal., with a capital stock of $75,000. The incorporators are Louis De Rome, G. W. West, H. G. Knowles, Frederick Mueller and William F. Gibson.

THE ATLANTIC & LAKE NICARAGUA RAILROAD & NAVIGATION COMPANY has filed articles of incorporation at Trenton, N. J. The incorporators are Ishman Sedgwick, Richmond, Ind.; Charles H. Hall and Peter Backes. Capital, $100,000.

THE AVA & SOUTHERN ILLINOIS TELEPHONE COMPANY, Ava, Ill., has been formed with a capital stock of $2,500. The incorporators are R. N. Stout, S. W. Tresh, J. Husband, T. M. Russell, William Bower, William C. Dean and George O. Dean.

THE WEINY-PHILLIPS COMPANY, of New York City, N. Y., has been incorporated for the purpose of manufacturing electrical instruments. The incorporators are Walter P. Phillips and Albert Suesman, New York, and R. H. Weiny, Arlington, N. J. Capital stock, $2,000.

THE LIBERTY & JEFFERSONVILLE ELECTRIC RAILROAD COMPANY, Liberty, N. Y., has been incorporated by Frank Lober, Wilhelmina Lober and Minnie Lober, to construct an electric line from Liberty to Jeffersonville. The capital stock of the company is $120,000.

THE PIKE COUNTY TELEPHONE COMPANY, Pittsfield, Ill., has been incorporated to do a general telephone business. The incorporators are W. S. Jennings, F. L. Seerenburg, Ed. D. Clandon, Ira Woodworth, O. Swanson, W. A. Skeel and J. F. Lacey. Capital stock, $1,500.

THE LOCKPORT TELEPHONE COMPANY, Lockport, N. Y., has been organized with a capital of $25,000. The directors are Lawrence J. McPartin, Peter H. McPartin, M. E. McPartin and S. Curt Lewis, of Lockport, and E. W. Clarke, of Fort Plain, Elmer E. Lummey, of Buffalo, and Isaac J. Evens, of Rome.

THE LEWISBURG & BUFFALO VALLEY RAILROAD COMPANY, Lewisburg, Pa., has been formed for the purpose of constructing an electric railway to run from Lewisburg to Kulp's station, a distance of fifteen miles. The directors are Monroe H. Kulp, G. Gilbert Kulp and Daniel C. Caseman. Capital stock, $30,000.

THE NORTH SIDE CONSTRUCTION COMPANY, Jamaica, L. I., N. Y., has been formed with a capital stock of $5,000, for the purpose of constructing electric, cable and compressed air railways, electric light, heat and power plants. The directors are C. S. Silkworth, John Graham, and George Muller, of Sea Cliff.

The Telegraph and Telephone.

GALESBURG, ILL.—There is talk of establishing a telephone line between this city and Henderson County towns.

PONTIAC, MICH.—A franchise has been granted to the new State Telephone Company to construct a line to Pontiac.

PAINESVILLE, OHIO.—The Painesville Telephone Company has been authorized to increase its capital stock from $10,000 to $20,000.

LEBANON, N. H.—Bradford, Vt., has voted to build an electric light plant. Further information can be obtained from Mr. Owen P. Briggs.

WILLMAR, MINN.—John Williams and O. Barnstadt, of this city, have applied for a franchise to establish a local telephone exchange system.

NOBLESVILLE, IND.—The Noblesville Telephone Company has decided to extend its lines to various towns and cities within a radius of 100 miles of this city.

McCONNELLSVILLE, OHIO.—The Drake Selector Telephone system, which has been in operation here, has given such satisfaction that the company contemplates enlarging the same for the accommodation of fifty instruments.

BENTON HARBOR, MICH.—The Bell Telephone Company has reduced its rates to $16 for business houses and $15 for residences. This reduction was brought about, it is stated, by the organization of a new telephone company in this place.

MT. CLEMENS, MICH.—The City Council has notified the Bell Telephone Company that it cannot continue the erection of poles in the streets until it has obtained permission from the Council. The company, it is stated, has no franchise rights here.

STILLWATER, MINN.—Mr. A. T. Presson is seeking a franchise from the City Council to permit him to construct a telephone line from Stillwater to Hudson, where he is putting in an exchange. There is no doubt that he will receive the necessary permission.

CHAGRIN FALLS, OHIO.—The Chagrin Falls Telephone Company has just established a connection with Kent and Ravenna. In a few days it is expected that communication will be had with Hiram and Garrettsville. The lines, it is stated, are working very successfully.

OWOSSO, MICH.—The State Telephone Company has been granted a franchise by the City Council to carry on business here. The company will charge the usual rates of $24 and $18 for business and residence service, and the city will get telephones at $15 each per year. Consolidation with other companies is forbidden, and through service to Corunna is provided for.

DES MOINES, IOWA.—The Iowa Legislature has amended and passed a law which requires telegraph and telephone lines, in addition to the representation that they are now required to make to the Auditor of the State, to make annually a report, showing in detail their properties, capital, receipts and expenses. A penalty of $100 per day is provided for every day such companies refuse or neglect to make such reports.

BOSTON, MASS.—The Mexican Telephone Company has decided to introduce the metallic line service in the federal district of Mexico. The company charges its customers a yearly rental of $75. With the new metallic circuit improvements two additional services will be offered—the granular button at $100, and the long-distance transmitter at $125 per year. A large number of the merchants in Mexico, it is stated, have already expressed a willingness to subscribe for the improved service. For the present, the policy of the company will be in the direction of improving service already installed rather than in the extension of territory.

Electric Light and Power.

ASHLEY, PA.—The Economical Electric Light Company has been granted permission to build an electric light plant in Ashley.

SCOTTSBURG, IND.—George Koch, Matthew Dunlevy and James Dunlevy have been granted a franchise for an electric light plant.

GLASGOW, KY.—The Glasgow electric light plant was destroyed by fire on the morning of May 7. The loss is $19,000, and the insurance $15,000.

CAMBRIDGE, WIS.—A. R. Hoard has made a proposition to the citizens of Cambridge to put in an electric light plant in this village, providing the citizens will take 150 incandescent lights.

LEBANON, OHIO.—An election will be held June 7, to vote on the question of issuing $16,000 in bonds for constructing an electric lighting plant. R. B. Corwin, Clerk, can give further information.

BRAINERD, MINN.—Owing to the high water in the river which caused the backing up of the water in the flume, the operation of the water wheel at the electric light plant was interfered with, and the town was in darkness for several nights.

BELOIT, WIS.—The Beloit Water-Power Company is estimating the cost of distributing the water-power of Rock River by electricity. If the report of the engineer and committee having the work in hand is favorable, $10,000 will be expended in carrying out the project.

CHICAGO, ILL.—A controlling interest in the stock of the Cicero Water, Gas & Electric Light Company has been purchased by an Eastern syndicate. It is stated that the syndicate will increase the capital stock from $290,000 to $500,000, and float $500,000 bonds at 5 per cent.

GREEN BAY, WIS.—An option has been given on the light plant of the Green Bay Gas & Electric Light Company to the Fox River Electric & Railway Company of this city. The deal involves $300,000, and the object is the consolidation of the two plants. The option expires July 15.

LOUISVILLE, KY.—Judge Noble, in the Criminal Court recently, overruled a motion to dismiss the case of a saloon keeper who had tapped an electric wire, and who maintained that he had taken nothing of value. Judge Noble, however, decided that electricity is property, and that the case must be tried on its merits.

DES MOINES, IOWA.—The Light Committee of the City Council has decided to recommend for approval and submission to the people at the polls, a contract with the McCaskey & Holcomb Company, of Springfield, Ill., to erect a municipal electric light plant for the city, the plant to be a combination power and low-light system, the erection of which, according to the bid of this firm, is to cost $114,588.

WASHINGTON, D. C.—The United States Electric Lighting Company is about to award contracts for the construction of an entirely new electrical plant on the recently-acquired premises adjoining the present location. The estimated cost of the new plant will be $300,000, and the proceeds of the new 6 per cent. debenture improvement bonds, recently authorized, will be immediately available for that purpose.

The Electric Railway.

ATLANTA, GA.—It is stated that the Consolidated Street Railway Company will extend its lines from West End to Fort McPherson.

NEW YORK CITY, N. Y.—It is reported that the Putnam division of the New York Central & Hudson River Railroad will be equipped with electric power.

SYRACUSE, N. Y.—The application of the Suburban Railroad Company to increase its capital stock from $250,000 to $400,000 has been granted by the State Railroad Commissioners.

ST. MARY'S, OHIO.—The Lima & Piqua Electric Street Railroad Company has amended its charter, changing its name to the Lima & Piqua Railway Company, and its location to Sidney, Ohio.

PROVIDENCE, R. I.—The Selectmen of the town of Whitman have granted a franchise to a street railway company to lay tracks from the Bridgewater line to the Abington line, with the privilege of placing a second track on Second Avenue.

NYACK, N. Y.—Nyack is to have a trolley line which may develop into a much longer one in the near future. The Christian Alliance Syndicate is now arranging to establish a trolley road from some point near the South Nyack station to Nyack Heights.

BRIDGEWATER, MASS.—The Selectmen of Bridgewater have granted a franchise to the directors of the Bridgewater, Whitman & Rockland Street Railway Company to lay tracks from a point near the Consolidated Railroad station in Bridgewater to the East Bridgewater line.

Personal Notes.

MR. JOHN N. BECKLEY, president of the Rochester Street Railway Company, Rochester, N. Y., has resigned his position, and has been succeeded by Mr. Frederick Cook. Mr. Beckley will devote his time to other interests in which he is intimately concerned.

MR. FRANK X. CICOTT announces his intention of organizing an European company to handle American electrical apparatus as general agent abroad. Having had several years' experience abroad in commercial and journalistic lines, Mr. Cicott is familiar with the conditions in foreign countries, and possesses exceptional facilities to embark in a project of this nature. In order to make the necessary arrangements to inaugurate the new enterprise, Mr. Cicott has resigned his position with the Ansonia Brass & Copper Company, the resignation to take effect July 1, next.

MR. G. F. PACKARD, until recently connected with the Fort Wayne Electric Corporation, Fort Wayne, Ind., as designing engineer, has severed his connection with that company, and accepted a position as electrician for the Akron Electrical Manufacturing Company, Akron, Ohio. While with the Fort Wayne Electric Corporation Mr. Packard designed a line of multipolar direct-connected generators. He is now designing a new line of multipolar generators for direct connection; also a line of belt-driven, slow-speed multipolar generators and motors. These machines will be placed upon the market by the Akron Electrical Manufacturing Company at an early day.

Obituary Note.

MR. HORACE A. PINKHAM, manager of the American Electric Company, Boston, Mass., was killed by a train on the New York, New Haven & Hartford Railroad, at Wollaston depot, on May 15. Mr. Pinkham was seventy-two years of age, and well known in New England electrical circles.

Trade and Industrial Notes.

NEW ENGINE FOR THE FLEMINGTON PLANT.—The Ball & Wood Company is building a new 150-hp engine for the Flemington Electric Light, Heat & Power Company, Flemington, N. J.

READY FOR BUSINESS.—The Cleveland Engineering & Electric Company has opened an office at 229 Arcade Building, Cleveland, Ohio, where it intends doing a general construction and manufacturers' agency business.

HIGH-GRADE CARBONS.—The Globe Carbon Company, Ravenna, Ohio, having been reorganized, is now in a better position than ever to supply high-grade carbons for electric lighting. Its factories have been equipped with the latest improved machinery and appliances, which, together with the skill born of long experience, places the company a step in advance in the manufacture of arc-light carbons. Its carbons are well known for their long life and uniform quality.

STEVENS INSTITUTE.—The 1897-98 catalogue of the Stevens Institute of Technology, Hoboken, N. J., just issued, gives all the information an intending student desires to know regarding the plan of instruction. A complete calendar of the course, which occupies a period of four years, is given, together with specimens of entrance examination papers. At the back of the book is found a complete list of the alumni of the Institute having received the degree of Mechanical Engineer.

STORAGE BATTERIES as made by the Ohio Storage Battery Company, Cleveland, Ohio, are described and illustrated in a well-gotten-up catalogue just issued by that company. These batteries are applicable for every purpose where an electric current is required, and are said to be absolutely free from litigation, as they do not infringe the Brush or any other patents. They are supported and protected by United States patents of a broad nature, and constitute a distinct type.

ELECTRIC VEHICLES BECOMING POPULAR.—Self-propelling electric vehicles are evidently meeting with much popular favor, judging from the reported demands upon the facilities of the American Electric Vehicle Company, Chicago. The company is now moving into its new large factory, where it will be in a position to turn out carriages complete. It states that it is meeting with gratifying success in disposing of its vehicles, and that it has a large number of orders on hand, with many others immediately in sight.

SOLDERING FLUX for electrical work has been put on the market in a variety of different shapes. The latest thing in this line is Highland Insulating Soldering Paste, which is being placed before the trade by the Electric Appliance Company, Chicago. Great claims are made for this paste on account of its convenience and non-corrosive qualities. The Electric Appliance Company is prepared to send small sample boxes of this soldering paste to the trade on application, as it feels confident that its merits will bring business where it has once had a test.

BLOWERS AND GAS EXHAUSTERS.—The Green patented positive rotary-pressure blowers and gas exhausters are described and illustrated in a pamphlet just issued by the Wilbraham Baker Blower Company, Philadelphia, Pa. This machine is of the two-impeller type, and was designed to occupy the least space, displace the largest volume of air for the space occupied, exhaust and deliver an even volume, and be as simple as possible in construction and operation. Some valuable data are given concerning the use of blowers, in addition to the subject matter of the pamphlet.

THE MATTER OF LUBRICANTS is an important one in all establishments where machinery is in operation. Street railway and electric light managers, as well as manufacturers of apparatus, are alike concerned in lubricants. There are good lubricants and bad lubricants. Among the good ones—and a very good one it is said to be—is what is known in the trade as Albany Lubricating Compound, which is made by Messrs. Adam Cook's Sons, New York City. It is claimed that this compound will not gum; avoids dripping; prevents hot boxes; keeps motors in perfect order, and saves expense in repairs. For electric railway motors and journals it is said to be excellent.

SATISFACTION A STRONG RECOMMENDATION.—It is always pleasant and encouraging to receive acknowledgment of satisfaction with one's efforts and work, and the Onondaga Dynamo Company, Syracuse, N. Y., has good reason to feel elated over the receipt of a letter from the American Fire Engine Company, Seneca Falls, N. Y., of which the following is a copy: "We write to express our satisfaction with the electric lighting plant which you have recently installed in our factory. It works to perfection and exceeds our expectations in every particular. We shall be glad to operate it at any time for any one you may send here contemplating the purchase of such an outfit."

THE "DUPLEX" LAMP GUARD, which is one of the specialties of Messrs. Underwood & Co., Chicago, is considered one of the most complete devices of the kind on the market, and the firm is meeting with success in placing them before the trade. These guards will be made in the future in three styles: No. 1 being the standard guard, No. 2 will be made of heavier wire, and No. 3 will be made of extra heavy wire for use in mines and other places where great strength is required. Guard No. 3 will have two steel springs in place of one, as on Nos. 1 and 2. The outlook for the coming season is very encouraging, and the firm expects to ship in the very near future some very large orders.

A NEW INCANDESCENT LAMP COMPANY.—It is reported that a new incandescent lamp business will soon be started in Fort Wayne, Ind., and that Messrs. Samuel Insull and R. T. McDonald are the prime movers in the enterprise. The Fort Wayne Lamp Company is the name of the concern that will carry on the business, and it contemplates, so it is reported, purchasing the factory of the Adams-Bagnall Electric Company, Cleveland, Ohio, where incandescent lamps will be manufactured. It is said that close relations between the Fort Wayne Electric Corporation and the new concern will be established. The new company will enter the incandescent lamp field with every facility to turn out a high-grade product on a large scale.

ELECTRIC HEAT AS A CURATIVE AGENT.—Local application of heat has long been recognized by the medical profession as invaluable in the treatment of certain diseases, such as neuralgia, pneumonia, rheumatism, etc., and that the electric current should come to be utilized for such purposes is a logical sequence of electrical development. The Electrotherm made by the H. W. Johns Manufacturing Company, New York, is an article designed for this purpose. The ease and convenience with which this heating pad can be utilized for applying heat to the human body have already established it in the favor of the public and of the medical profession as a superior substitute for the old-time hot water bottle or poultice, whenever the electric current is accessible. It is a simple and effective device, and anyone interested can learn more about it by sending for a copy of the "Electrotherm "pamphlet.

THE BERLINER DECISION does not seem to have adversely affected the business of the Western Telephone Construction Company: in fact, that company reports a more favorable business since the decision than it had previous thereto. It reports contracts, since the decision, for seven new telephone exchange, involving the use of over 2000 telephones. Some of these contracts are for furnishing apparatus in place of other makes. Among the contracts are 300 for Spartansburg, S. C.; 150 for Florence, Ala.; 300 for a new branch exchange at Fort Wayne, Ind.; 100 for Aledo, Ill.; 200 for Cameron, Mo., and other places. It is asserted by the company that its business will show a very large increase in the next three months, and, as an evidence of this, it is putting in a large amount of new machinery and extending its factory capacity once more. It reports additional orders from nearly all of its present exchanges, which were held, awaiting the exact position of the Supreme Court upon the Berliner patent.

A MODERN ALTERNATOR.—The Warren alternating dynamo is growing so popular that the Warren Electric Manufacturing Company, Sandusky, Ohio, the maker of the same, is compelled to run its factory night and day in order to keep up with the demand. This machine is of a most modern type and is designed to give the greatest results with the least expenditure of trouble and power. It is so simple that an ordinary mechanic can care for it as well as a skilled electrician. It has no brushes nor commutators to burn out, and the armature coils are stationary. The rotor revolves in an intense magnetic field, which is always at its maximum. Among the numerous sales recently made by this company are the following: San Mateo Electric Light & Power Company, California; Lake City Electric Light & Power Company, Florida; Crowned King Mining Company, Crowned King, Ariz.; Holland Trust Company, New York; Nichols Electric Light & Power Company, Nutley, N. J.; City of Willmar, Minn.; City of Lodi, Ill.; Fonda Electric Light & Power Company, Fonda, N. Y.; City of Table Grove, Ill.; California Electrical Works, San Francisco; Geo. M. Schambs, Cardington, Ohio; Pueblo Heat, Light & Power Company, Pueblo, Col. Messrs. H. B. Coho & Co., New York, are the agents in New York and vicinity.

Business Notice.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 11, 1897.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

582,200. TELEPHONE TRANSMITTER; R. P. Green, Columbus, Ohio. App. filed Jan. 11, 1897. A microphonic element composed of oxygenated sulfid containing an excess of copper.

582,218. ELECTRIC MOTOR; J. A. Mosher, Chicago, Ill. App. filed Feb. 9, 1893. As a new article of manufacture, an armature for electromagnets, consisting of a number of plates arranged in succession upon a shaft obliquely to the axis thereof.

582,233. GOVERNING DEVICE FOR FLUID PRESSURE MOTORS; F. M. Rites, Ithaca, N. Y. App. filed Jan. 13, 1897. The combination with a fluid pressure motor, a governor, and means independent of the governor, and connected with the valve gear of the motor, which is adapted to automatically adjust the governor.

582,237. ELECTRICALLY PROPELLED AGRICULTURAL IMPLEment; H. Schipff, Halle-on-the-Saale, Germany. App. filed Sept. 25, 1896. Means for transmitting electrical energy to electrically-driven agricultural implements, comprising a bare conductor, portable supports therefor provided with a conductive track electrically connected with said conductor, a motor carriage, and a rigid sliding contact on said carriage adapted to slide along said bare conductor and along the under side of the conductive track of its support.

582,259. ELECTRIC TROLLEY DEVICE; W. M. Brown, Johnstown, Pa. App. filed Dec. 16, 1896. In a trolley device for electric railways, in combination, an upwardly pressed tube having a longitudinal opening, a member adapted to move longitudinally along said tube and bearing on the inside thereof, and a contact maker mounted upon said moving member.

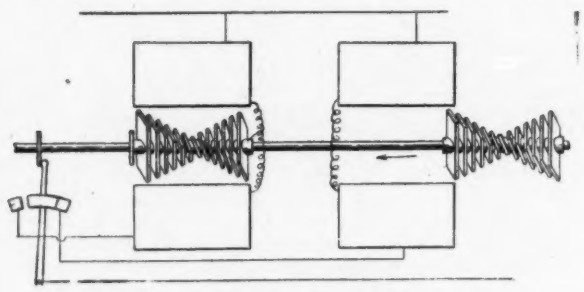
582,262. ELECTRICALLY-ACTUATED SWITCH; J. Bryan, Pittsburg, Pa. App. filed Aug. 1, 1896. In a switch-operating mechanism, the combination of a movable switch point, a lever, a cam mechanism for operating said lever, a magnet for operating the cam mechanism, and a yielding connection between the lever and the movable switch-point.

582,269. ARMATURE FOR DYNAMO ELECTRIC MACHINES; E. P. Clark, New York, N. Y. App. filed July 16, 1896. An armature core for dynamo electric machines and motors, built up of sections, each of which is composed of iron plates or punchings having the general shape of the letter "H" with one of its sides removed, the said plates being in tiers or piles and arranged in the section with their side pieces alternately to the right and left, and with their cross pieces overlapping each other.

582,273. ELECTRICAL STRIKING AND ALARM ATTACHMENT FOR CLOCKS; B. De Witt, Terra Alta, W. Va. App. filed April 20, 1896. In an electrical attachment for clocks, the combination with a vibratory hammer of a striking clock, of a circuit-closing device comprising oppositely arranged contact rods disposed in linear alignment, one of said rods being provided with an arched portion spanning the vibratory hammer-rod, a spring pressed contact-foot pivotally mounted on one end of the arched rod and normally disposed in a position out of contact with the adjacent end of the other rod and in the path of the movement of said hammer-rod, suitably arranged supports for the contact rods to permit of their longitudinal adjustment, electric bells arranged at points remote from the circuit closing device, and an electric circuit having wire connections with the bells and said contact rods.

582,303. ELECTRIC SWITCH; W. J. Newton, New York, N. Y. App. filed Jan. 28, 1897. In a wall switch, the combination with an insulating body having stationary contacts at the edge, of a metallic frame secured to such body and having a post and arms with a rocking lever, a manual lever, and push-pins fitted movably to such frame, said parts being adapted for adjustment apart from the body, and for co-operation with the stationary contacts when the frame is secured to the body.

582,337. TROLLEY WIRE HANGER; J. E. Atwood, Stonington, Conn. App. filed Oct. 12, 1895. In combination, a trolley wire, clamping plates



No. 582,218.—Electric Motor.

extending along the wire and having jaws for partially embracing the same, bolts extending transversely through the plates for locking them to the wire, a supporting-wire, insulating plates above and below the supporting wire, a bearing-plate located above the upper insulating-plate and locking-bolts having their heads seated in the clamping-plates and engaging the said insulating and bearing plates for securing the supporting-wire and trolley-wire together.

582,344. SUPPORT FOR TROLLEY WIRES; W. J. Cook, Cleveland, Ohio. App. filed March 6, 1897. The combination with a trolley wire of greater diameter in one direction than in the other direction, of a trolley ear having a chambered groove with an opening less than the diameter of said chamber, said wire being adapted to be inserted into said groove when turned to an unusual position and be held in said groove by the sides thereof when turned to the normal or supporting position.

582,378. CARBON FOR ARC LAMPS; J. D. Smith, Washington, D. C. App. filed March 1, 1897. In a carbon for arc lamps, the combination of a carbon and a piece of insulating material attached to the carbon and interposed in the path of the arc to extinguish the arc.

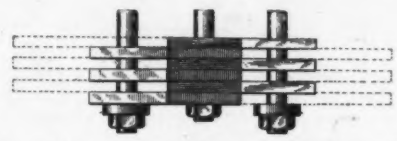
582,396. INSULATOR; W. G. Schnee, Pueblo, Col. App. filed Feb. 26, 1897. An insulator comprising a post or peg having radial lugs provided with inclined lower edges and a flexible disc mounted on the top of said peg, in combination with a bell-shaped hood, the inner walls of which are provided with a horizontal annular flange having vertical cut-away portions and having its upper end terminating in a semisphere formed with an annular flange having vertical rectangular guide-recesses, retaining recesses, and a vertical longitudinal groove, the opposite walls of which are provided with integral vertical ribs and a removable semicircular cap having inclined lower faces and oppositely disposed internally projecting integral lugs.

582,461. ELECTRICAL INDICATING DEVICE; W. W. Dean, St. Louis, Mo. App. filed Sept. 19, 1896. In an electric signaling device, the combination with an electromagnet, of laterally extended pole pieces provided thereon, a bodily movable armature continuously maintained between said pole-pieces and a support for said armature adapted to permit the bodily movement thereof to the position approximately of the maximum magnetic intensity of the pole-pieces when the said pole-pieces are energized, whereby a signal is effected.

582,462. ELECTRIC CIRCUIT TERMINAL; E. N. Dickerson, New York, N. Y. App. filed April 5, 1897. An electric terminal attached to a circuit wire, the same consisting of a substantially U-shaped flat portion, one of the arms of the U being provided with a rounded projection.

582,464. ELECTRIC CONTACT; C. C. Dusenbury, Lake Mahopac, N. Y. App. filed Feb. 8, 1897. An electric contact, comprising a block of metal to which one circuit-wire is attached and a bushing of rubber or other insulating material within an opening in the block to receive the end of the other circuit wire, and a thumb screw or equivalent metal clamping device passing into the metal block and through an opening in said bushing, the rotation of which screw causes the point to come into metallic contact with the wire within the bushing and make the circuit, or to move away therefrom and break the circuit.

582,481. FASTENING MEANS FOR CORE PLATES OF ELECTRICAL MACHINES; E. E. Nolan, Wilkinsburg, Pa. App. filed Jan. 20, 1897. A core for electrical machines comprising a casting having a cylindrical



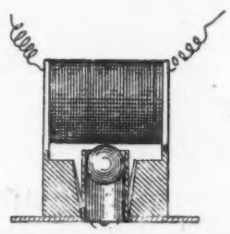
No. 582,269.—Armature for Dynamo Electric Machines.

surface and provided with a circumferential flange at or near one end and a circumferential groove at or near the other end, an annular plate adjacent to said groove, laminae clamped between the flange and the annular plate, and a fastening ring located partially in said groove and bearing against the outer side of said annular groove.

582,493. ELECTRIC METER; G. A. J. Talge, Oldensburg, Germany. App. filed Nov. 16, 1896. In electricity meters, the combination with the pendulum of a clock work, a coil for the current to be measured, and a core for co-operation with said coil, of pivotally-arranged upright springs, one on each side of the pendulum, and means for transmitting the movements resulting from the action of the coil on its core, to said springs.

582,494. CORE FOR ELECTRICAL MACHINES; G. Westinghouse, Pittsburg, Pa. App. filed Jan. 20, 1897. A core for electrical machines comprising a casting having a cylindrical surface and provided with a laterally projecting flange at or near one end and with a circumferential groove at or near the other end, an annular plate having a circumferential groove, laminae clamped between said annular plate and the flange on the casting, and a fastening-ring located partially in the circumferential groove in the casting and partially in the corresponding groove in the annular plate.

582,513. TELEPHONE TRANSMITTER; H. C. Alexander, Bonham, Texas. App. filed Dec. 4, 1896. A telephone transmitter comprising a metal shell open at its front and having a central opening through its rear wall, a carbon disc in the shell having a cell extended through the back of the shell, a block of insulating material secured to the back of the shell, a granulated electrode in the cell, a post extending through the cell, a contact plate in engagement with the rear end of the post, a diaphragm



No. 582,461.—Electrical Indicating Device.

in the shell and having a contact with the post and shell, and a soft textile material between the diaphragm and carbon disc, the said textile material being cemented in place.

582,514. OUTLET INSULATOR; A. M. Anderson, Boston, Mass. App. filed March 16, 1897. As an improved article of manufacture, an outlet insulator for interior-conduit systems, consisting of a sleeve or insulating material provided on its interior with screw-threads.

582,522. TELEPHONE; C. F. Dunderdale, Chicago, Ill. App. filed June 17, 1895. In a telephone-receiver a temperature compensating device, consisting of a bent bridge secured to the receiver casing at each of its sides and supporting the magnet or magnets, the extension piece of said magnet being secured to the bridge at that end thereof remote from the diaphragm, whereby the bent portions of the bridge are adapted to expand or contract in one direction and the extension piece in the other, and preserve constant the distance between the end of the extension piece and the diaphragm.

582,578. SYSTEM OF ELECTRICAL INTERCOMMUNICATION; E. A. Clark, Sioux City, Iowa; and J. P. Ellacott and W. J. O. Johnson, Chicago, Ill. App. filed Sept. 28, 1893. In a transmitter, the combination with a rotary indicator adapted to be set in one or more positions in a prescribed path, and circuit-changing mechanism moving in a path, the centre of movement of which corresponds to that in which said indicator moves, of a yielding connection between said indicator and said circuit-changing mechanism for causing movement of said circuit-changing mechanism in the direction of movement of the indicator, after each setting of the indicator, to a position corresponding to that occupied by the same.